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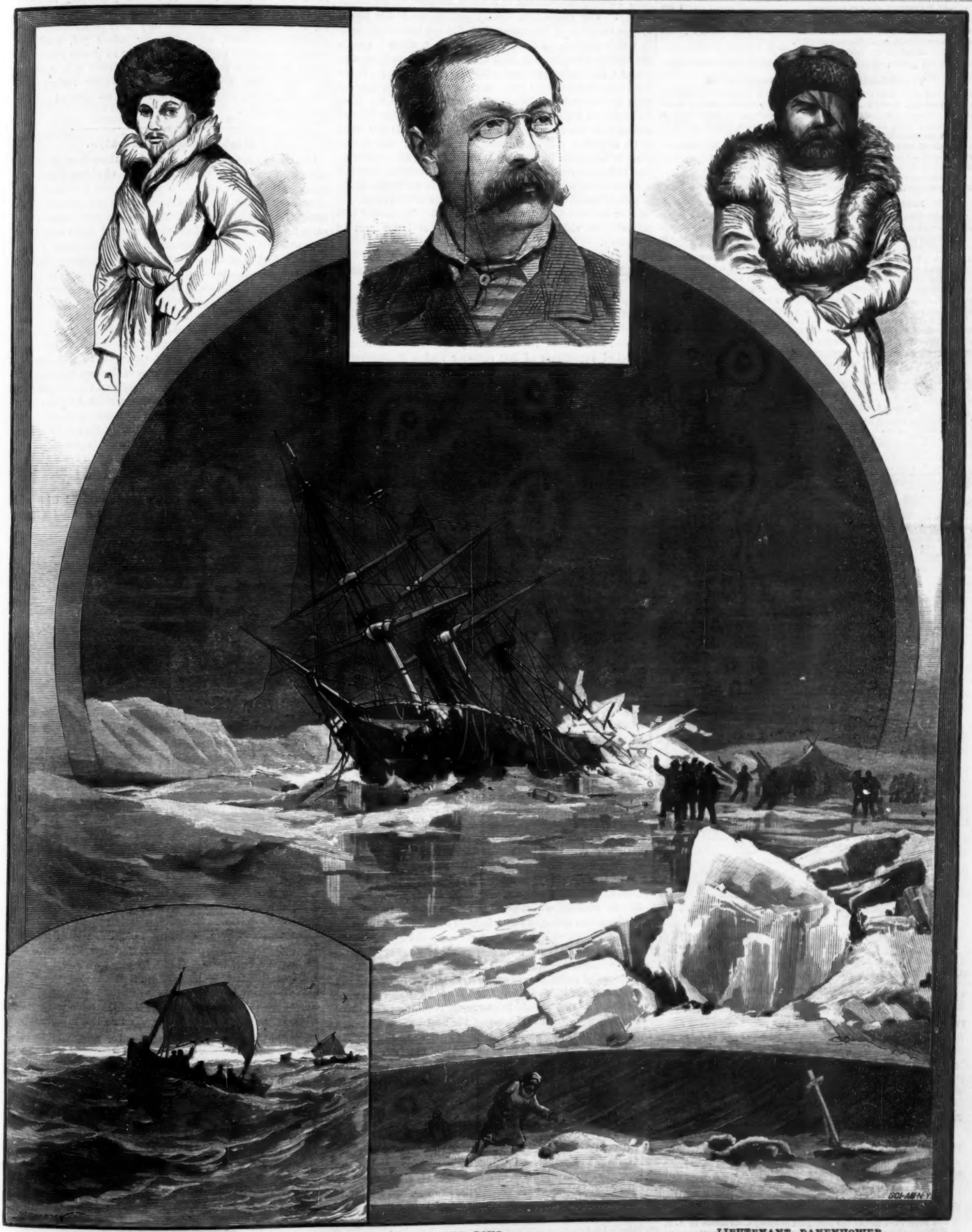

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# Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 23, 1884.


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(Illustrated articles are marked with an asterisk.)



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**THE SCIENTIFIC AMERICAN SUPPLEMENT**

**No. 425,**

**For the Week ending February 23, 1884.**

Price 10 cents. For sale by all newsdealers.



**IT WAS THE PONS-BROOKS COMET.**

A correspondent in Iowa Falls, Iowa, writes that he looked in vain for the Pons-Brooks comet in the northwest. On the 14th of January, however, "he discovered directly in the southwest a comet about 30° above the horizon, with its tail pointing in an easterly direction."

He wishes to know "if the newspaper accounts of the Pons-Brooks comet have located it in the wrong place, or if the one he has lately seen is a new visitor of the comet family."

The comet seen in the southwest by our correspondent is the Pons-Brooks comet, the same celestial visitor that was first visible to the naked eye in the northwest. It has not been wrongly located, nor is it a new member of the comet family. The comet was faintly perceptible to the naked eye on the 27th of November, but did not become distinctly visible until about the 21st of December, when it was in the constellation Cygnus, high up in the northwest, appearing as a faint nebulous mass with a very short tail. It has been observed on every clear, moonless night since, moving with inconceivable velocity to the southeast, passing from Cygnus into Pegasus and into Pisces, where, on the 14th of January, it was found by our correspondent. It was then at its brightest point and nearest to the earth. Since that time it has passed its perihelion, or nearest point to the sun, and is now decreasing in luster and diminishing in size, but still traveling southeast as it rapidly wings its flight to the depths of space where no human eye can track its course, to be seen no more till its next return in 1955. The comet will probably be visible in this latitude till the latter part of February.

**RELIEF EXPEDITIONS FOR THE AMERICAN COLONY AT LADY FRANKLIN BAY.**

The sealing steamer Bear has been purchased at St. John's, Newfoundland, for the Greely Relief Expedition, also at Dundee the whaler Thetis. Still another vessel is to be selected and bought for the same purpose. The failure of the relief expedition of last summer makes it imperative that no time be lost in getting help to the colonists, now probably at Littleton Island, about 1600 miles north of Disco, Greenland, and no risk run of a defeat of the undertaking by the loss of a single vessel.

For the solution of certain meteorological problems, Lieut. Weyprecht, the Austrian explorer, now dead, proposed a scheme of simultaneous observation to be undertaken jointly in Arctic regions by the leading nations of the world. At the three international Polar Conferences, held at Hamburg in 1879, at Berne in 1880, and at St. Petersburg in 1881, the programme and details were settled. At the last meeting it was decided to delay the beginning of the enterprise from 1881, as first proposed, until 1882. Preparations had been made in this country, however, for carrying out our part of the original programme; and in the summer of 1881 two expeditions set out, one for the northernmost point of Alaska, under Lieut. P. H. Ray, the other under Lieut. A. W. Greely for Discovery Harbor, Lady Franklin Bay, 81° 50′ N. lat. and 65° W. long., 500 miles from the Pole. The other ten stations selected were: Fort Rae, north of Manitoba, by the British; Cumberland Island, north of Hudson's Bay, by the Germans; Goodhaab, Greenland, by the Danes; Jan Mayen Island, by Austria; Spitzbergen, by the Swedes; Bosskopp, near North Cape, by Norway; a point near the White Sea, by Finland; Nova Zembla, by the Russians, who had another station at the mouth of the Lena River in Siberia; and Dickson Haven, near the mouth of the Yenisei River, by the Dutch.

The Dutch expedition failed to reach its destination, having been caught in the ice in the Kara Sea. Observations were made during the winter, however, and the party made good their escape when their vessel sank, on the breaking up of the ice the following summer. All the other expeditions were successful, with the possible exception of the most northerly one of all, that of Lieut. Greely, at Discovery Harbor, from which nothing has been heard.

The Greely party, numbering twenty-four in all, sailed from St. John's in August, and reached their destination easily; the Proteus, which conveyed them, had no trouble from the ice either going or returning. The colony was provided with a house, with boats, and with provisions and stores for two years. Near them was a bed of good coal, so that they were sure of a plentiful supply of fuel. It was agreed that a relief party should be sent them the following summer, to replenish their stores and bring away any that might be sick. If that should fail to reach them, an effort should be made to bring them all away the next summer, 1883. In the event that the second expedition should fail to appear, the colony were to abandon the station not later than the first of September, 1883, and make their way to Littleton Island, where supplies would be left them, in case they were not previously picked up.

The first relief expedition was stopped by ice long before it reached the neighborhood of the colonists. It made a deposit of provisions and stores at Cape Sabine, near the south extremity of Smith's Sound, 250 miles south of Discovery Harbor, and returned home. The attempt made last summer, in two vessels, to reach and succor the colonists failed disastrously; one of the vessels, the Proteus, was lost, and no stores were left for the retreating colonists when they should reach Littleton Island. It is possible that on learning of the misadventure of Garlington's expedition, when reaching Cape Sabine, Lieut. Greely may have returned to his old quarters at Discovery Harbor, where he would have shelter at least, and possibly stores enough to keep his men alive through the winter. This on the assumption that the party had weathered the two preceding winters in health and safety. But where there are so many contingencies, it is useless to speculate with regard to their fate. If they came down to Littleton Island last fall, as proposed, they would be 225 miles from Cape York, where they might find Esquimaux and doubtful assistance during the winter; or possibly they might have been able to reach Upernavik, 550 miles further south, if favored with good weather, health, strength, and sufficient supplies. At several points between Lady Franklin Bay and Cape Sabine are deposits of provisions and stores left by previous expeditions, which may have helped them out materially; there is thus a possibility that the colonists are somewhere fairly well sheltered and provisioned. It is equally possible that they may be all dead from starvation, exposure, or disease; or worse yet, painfully struggling against every hardship only to perish miserably before help shall reach them. In any case it is essential that the coming relief expedition be wisely manned and amply equipped, and that it shall waste no time in getting to its destination.

**Rapid Transit in Brooklyn.**

In no other city of the country has there been so much talk about local rapid transit by means of elevated railways as across the narrow arm of sea which divides Brooklyn from New York. The success of the New York system led to many attempts to obtain charters for different routes, but, except a small portion of an elevated road built five years ago, and never operated, nothing has yet been done. There has been local opposition, because of the supposed damage a road might occasion to property on the best routes, and capitalists are naturally wary of investing in so expensive a structure to be built outside of the natural lines of travel. After much talk, however, it seems quite likely that something definite will be done during the present year, on one or more of the half dozen different lines that have been projected. The objecting property owners have seen that the New York elevated roads have been of decided advantage to real estate in some sections, even directly on the lines of their route, as is conspicuously noticeable in Sixth Avenue, while they have wonderfully stimulated building and advanced the price of lots in the whole upper part of New York Island. That an elevated road system in Brooklyn would have a similar if not as great an effect in stimulating the growth of that city in the much larger area of low-priced lands in its outlying wards cannot be doubted.

Brooklyn is peculiarly situated, as compared with any other large city of the Union. Though the third of our cities in population, it has no real business center in the sense that other cities have. It is spread out over a comparatively wide area, from every quarter of which a living tide of people flows to New York all the early part of the day, to return as regularly at night. So widely are its suburbs separated, however, that in only two or three directions is there sufficient population on direct routes of travel to encourage the building of elevated railways; even on these there could not at once be a business done equal to that which the New York roads are doing, but that the travel would pay at the start a good interest on such roads, economically built, there is no reasonable doubt.

The bridge has not had the amount of travel that was expected, for its car service has been inadequate, and the terminals in the two cities are far from what they should be. But with these faults removed, and an efficient rapid transit system for Brooklyn making direct connection with the Bridge system, at least a half million people would be materially benefited in their daily life, and the growth of Brooklyn, particularly, greatly accelerated.

**Sugar in Tobacco.**

That tobacco, as ordinarily prepared by some of the manufacturers, is frequently sweetened with molasses, honey, licorice, etc., is not doubted, but we think it will be a surprise to most people to learn that a considerable percentage of sugar is a natural constituent of tobacco. Yet such has been demonstrated to be the fact by Prof. Attfield, F.R.S. Eight samples were obtained from planters in different parts of Virginia, Kentucky, and North Carolina which gave, to 100 parts of leaf, from 5·57 to 9·60 parts of tobacco sugar, and from 8·23 to 12·80 parts of total saccharoid matter. In tobacco grown in unfavorable conditions, or without sufficient heat, the amount of sugar is often but a mere trace, while for light colored or bright Virginia leaf it will average about ten per cent.

**Anti-Postal Medicine Law.**

A bill to "prevent the use of the mails to advertise noxious and dangerous medicines," etc., has been introduced in the House, the regulating of the matter to be delegated to the Patent Office. It provides that no advertisement of any kind or nature, or advertising device of any medical preparation, compound, or prescription, or any punch, bitters, etc., used as a beverage or as food or medicine, shall be carried in the mails until the exact formula thereof, with a sample, be placed in the Patent Office, examined, and substantiated by affidavits, and the issue of a certificate therefor, at a cost of $20. This would seem to be a very sweeping bill, covering many things not known as patent medicines, and its provisions are almost broad enough to cover even physicians' prescriptions.

### Care of Sick Patients.

A writer in the Boston *Traveller* gives some practical hints in ministering to the sick which are worth heeding. To be a good nurse requires a rare combination of excellences in the same individual — intelligence, physical strength, a kind disposition with firmness, a light hand and foot, courage greater than that which animates the soldier on the battle field, and, above all, untiring patience. Given these, and the nurse becomes more than half the remedy; not only inspiring confidence on the part of the patient, but of the surgeon or physician also, who can rely that his instructions will be carried out with implicit obedience to the letter.

Such a paragon, however, is rarely to be met with, except as an emissary from one or another of those admirable institutions where ladies are trained under skillful management for this work; and in a vast majority of cases an invalid is placed in the hands of his immediate friends or relations, who, with the best intentions, it must be confessed, often prejudice his comfort and retard his recovery by the very over-anxiety which is bred of affection.

The writer, after penning the above, proceeds to enumerate a few small points which should be avoided, as tending greatly to the discomfort of the patient, and for the guidance of those who, without previous experience, find themselves suddenly thrust into this most responsible position. Quietude is a great thing, of course, but real quietude means the absence of all excitement, and it must be remembered that anything out of the common will tend to excite the mind of a sufferer. Do not, therefore, walk on tip toe, for this, in addition to its unusual elaboration of the gait, invariably causes a certain amount of creaking. Speak in low tones, but don't whisper. A whisper will often awake a sleeper who would not be disturbed by an ordinary conversation; and never say "hush!" Let your clothes and foot covering be of as noiseless and unobtrusive a character as possible, and instead of gliding and tottering about like a rickety ghost, do not hesitate to walk. If you have occasion to say anything in the room, say it so that the patient can hear it if he wishes, and do not let him be aware of your conspiring privately with the others, especially at the door.

That door has much to answer for. If it be visible from the bed, people open it cautiously, put their heads in, and slowly withdraw again. If, as is more frequently the case, it is screened by the bed curtains, mysterious openings and shuttings are heard, unattended with any apparent ingress or egress, and *sotto voce* colloquies going on outside. When you enter, do so honestly and at once. Do not spend five minutes in turning the handle, like a housebreaker, thereby producing a series of irritating little clicks, finally terminating in a big snap, with which the door flies open. If the latch be at all rusty, a handle that is slowly wound back in this way will often stick, and either require to be rattled back in position, or, if left as it is, may start back suddenly, after a time, of its own accord, with a report like a pistol shot.

While talking to him it is better to sit by the side of the bed and as near the pillow as possible, so that you may converse easily, while your face and body are turned in the same direction as his. By this means you can make all necessary observation of his features without enforcing the arrest of his eyes to your own, which is so embarrassing and disagreeable to one lying in bed, and is almost unavoidable when facing him. Keep him in as comfortable a position as possible, by all means, but don't be too demonstrative in smoothing the pillows and little offices of that sort. Fidgety attentions will worry him and do him more harm than downright neglect.

### Limits of Hearing.

Attention has been directed of late to the experiments made by M. Panchon on the limits of hearing, the results being communicated to the French Academy of Sciences. The notes were produced by a powerful siren of the kind invented by Cagniard-Hatour, and actuated by steam. It seems that the highest audible notes produced in this way had 72,000 vibrations per minute. M. Panchon has also vibrated metal stems fixed at one end and rubbed with cloth powdered with colophane. In diminishing the length of the stem the sharpness of the note is increased. Curiously enough, he finds that the length of stem giving the limiting sound is independent of its diameter; and for steel, copper, and silver, the lengths are in ratio to the respective velocities of sound in these metals—that is, as 1·000 for copper, 1·002 for steel, and 0·995 for silver. Colophane appears to be the best rubbing substance.

### Manganese Varnishes.

These varnishes are prepared with the aid of the oxide, peroxide, and suboxide of manganese, but especially with the borate. The last named produces an article of such excellence, says the *Metallarbeiter*, that it is to be preferred to all other preparations used for similar purposes.

Borate of manganese varnish is made as follows: Four pounds of perfectly dry white borate of manganese, free from iron, are finely pulverized and gradually stirred into twenty pounds of linseed oil, which is heated in a suitable vessel.

By continual stirring the salt is uniformly distributed through the liquid, which is heated until the oil has a temperature of about 400° Fahr. It must be remembered that the borate must be free from iron to produce a rapidly drying varnish.

Two thousand pounds of oil are heated simultaneously in the varnish kettle until it begins to bubble up, when the mixture of oil and borate is allowed to flow in a fine stream into the kettle, the fire is increased, and the whole mass boiled violently. In about twenty minutes the varnish is done and ready to be ladled out. It is filtered hot through cotton, and is ready for immediate use.

Strips of wood that had been dipped into this varnish while hot were, at the expiration of 16 or 18 hours, covered with a perfectly dry and glassy enamel. Experiments proved that borate of manganese possessed the property of converting linseed oil into a rapidly drying varnish at a comparatively low temperature. A temperature of 104° Fahr. will suffice. If a linen bag containing about an ounce of borate of manganese be suspended in two gallons of oil, and the bottle containing it be placed in a vessel of water and kept in a warm place, the oil will be converted into a drying varnish in 10 to 14 days.

P. N.

### Mechanics Who Rise.

There is a large sized nugget of truth in this from Dr. J. M. Buckley's series of "Letters to Young Men," in the New York *Christian Advocate:*

"Benjamin Franklin told the truth when he said that the best knowledge a man could give to his son was the mastery of a good trade. Such a man is cosmopolitan. He can make himself useful anywhere, and he can live anywhere. If it should not be necessary always to work at his trade, he feels the ability within to support himself. . . . Between the average mechanic and the great manufacturer or merchant prince, great numbers can be found who began as mechanics and who have taken positions by their mechanical skill fully equal to that of the average merchant and far superior to that of most clerks and professional men. . . .

Always have in view rising above the position of a mere journeyman. Look at things from a broad, business point of view. Consider that some day you may not be a journeyman, and try to study the relations of capital to labor, and to master the principles of business, so that, if you should ever form a partnership with a business man, you will not be at his mercy, and so that, if you choose, you may at any time enter upon business for yourself, and not fritter away your life in a vain effort to overcome by mechanical skill financial obstacles."

### Cigarette Smoking.

There has been introduced into the New York Assembly a bill which prohibits the sale of cigarettes or tobacco to minors under 16 years of age. A law to that effect already exists in New Jersey, and its example might advantageously by followed in other States.

In regard to the results of cigarette smoking, physicians say it affects seriously the functions of the stomach, especially in the young. It has a tendency to increase the action of the heart, causing palpitation. It is a fruitful source of indigestion. It has a decided tendency to produce catarrh in the head. This, it is said, arises from the fact that a cigarette being much shorter than a cigar, more of the smoke finds its way into the mouth and nasal organs, a very much larger percentage of smoke being inhaled by the smoker from a cigarette than from a cigar. Cigarette smoking, it is averred, has also a decided tendency to produce asthma, and renders the system more liable to the attacks of pneumonia and bronchitis. In its effects upon the nervous system cigarette smoking is said to be in the highest degree pernicious, both directly and indirectly. It destroys healthy appetite for solid food, and by the constant expectoration it produces leads to a morbid craving for drink. Injury or destruction of the nerves of the eyes, it is alleged, has been in hundreds of instances produced by cigarette smoking.

### A Striking Tableau.

Gulian C. Verplanck relates that La Fayette, just before his death, was invited, in company with the American Ambassador and several other Americans, to the house of that distinguished Frenchman, Marbois, who was the French Secretary of Legation here during the Revolution. At the supper hour the company were shown into a room which contrasted quite oddly with the Parisian elegance of the other apartments where they had spent the evening. A low, boarded, painted ceiling, with large beams, a single, small, uncurtained window, with numerous small doors, as well as the general style of the whole, gave, at first, the idea of the kitchen or largest room of a Dutch or Belgian farm house. On a long, rough table was a repast, just as little in keeping with the refined kitchens of Paris as the room was in its architecture. It consisted of a large dish of meat, uncouth-looking pastry, and wine in decanters and bottles, accompanied by glasses and silver mugs, such as indicated other habits and tastes than those of modern Paris. "Do you know where we now are?" said the host to La Fayette and his companions. They paused for a few minutes in surprise. They had seen something like this before, but when and where? "Ah! the seven doors and one window," said La Fayette, "and the silver camp goblets, such as the marshals of France used in my youth. We are at Washington's headquarters on the Hudson fifty years ago."

### A Lead Varnish without Boiling.

The *Metallarbeiter* gives the following proportions for a lead varnish: 7 parts of sugar of lead, 5 parts of litharge, and 100 parts of linseed oil. The sugar of lead (acetate of lead) is dissolved in water and oxide of lead (litharge) added to form a basic acetate. The litharge is first triturated with a small portion of the oil, then stirred up with the remainder of the oil and added to the acetate. By stirring it hard for at least one and a half or two hours the two liquids become intimately mixed. After the stirring is ended, the liquid is left to stand until it has separated into two distinct layers, the lower containing the acetate of lead and the upper the varnish. When prepared in this way it is light colored, and forms a thin liquid that can be filtered through cotton or felt. Its thinness also permits the dissolved lead to separate.

It is well known that sulphuric acid forms an insoluble sulphate of lead wherever it comes in contact with soluble lead compounds. To this varnish is added 1 per cent of sulphuric acid diluted with 5 parts of water, and the mixture stirred for half an hour. The varnish then acquires a milky appearance, but soon clarifies itself, for the heavy sulphate of lead settles rapidly to the bottom.

A good varnish can also be prepared by mixing litharge, red lead, and sugar of lead, without the necessity of actually boiling it.

One part each of litharge and red lead are very intimately mixed. One pound of this mixture is put in a bag made of thick, close linen; 30 pounds of water and the same volume (15 quarts) of linseed oil are put in a vessel and heated until all the water has evaporated. [Probably the bag of lead compounds is placed in it and boiled, although our informant fails to state this.—TR.] The varnish is then filtered, while still hot, through felt. This method, like the former, is adapted to those establishments which make their own varnishes, as it can be made on an ordinary cooking stove, and there is no danger from fire, and it dries rapidly.

### Temperament in Relation to the Teeth.

When the artificiality of artificial teeth is noticeable, the dentist has failed in a most important part of his work. He may have supplied dentures to serve the wearer for speech and mastication, but which, from an æsthetic point of view, are incongruous and unsightly. Dr. J. Foster Flagg, Professor of Dental Pathology and Therapeutics in the Philadelphia Dental College, has shown some of the causes of these mistakes in what he has written about the temperament in relation to the teeth. Starting from the four basic temperaments, bilious, sanguine, nervous, and lymphatic—following the marked distinctions of each through the various sub-classes of mixed temperaments—he shows how important is a thorough study of temperament for the successful practice of dentistry. The bilious temperament is marked by teeth that are bronze yellow, large and inclined to angular, set firm and close, with the gums heavy and firm, but inclined to angularity; the teeth of the sanguine are creamy yellow and inclined to translucency, well proportioned, smooth, moderately firm, with gums round and full; the nervous have pearl blue or gray teeth, with length predominating over breadth—inclined to transparency, and with the gums delicate, shapely, and fine; the teeth of the lymphatic are pallid and opaque, or muddy in coloring—large but not shapely, loose and flat, incisors devoid of depressions and elevations, and the gums thick and undefined in shape.

While a knowledge of the different varieties of the teeth naturally belonging to persons of different temperaments is thus seen to be important, in order that there may be a proper correspondence of the teeth with other physical characteristics, we suppose there is to be commended a sort of Darwinian selection, which will give each subject who has thus to be supplied with artificial teeth the advantage of the best selection in the class to which he or she belongs. This may be done, however, without "associating the massive tooth of the bilious with the pearl blue color of the nervous, or the long, narrow teeth of the nervous with the bronze yellow of the bilious," as is now occasionally done by some who, while they may be good dental mechanics, are certainly not dental artists.

### Improved Water Gauge for Boilers.

Steam boilers are usually provided with a glass tube connected with the boiler in such a manner as to show the height of the water within. Being heated intensely by the water within, they frequently crack if a draught of cold air strikes them from without. This may be prevented, says the *Industrie Blatter*, by using two concentric glass tubes. Between the inner and the outer tubes an elastic strata of air is imprisoned that protects the inner one from draughts, the outer one from the heated water. Both tubes are packed at each end in brass couplings that connect with the boiler, and both form but a single instrument.

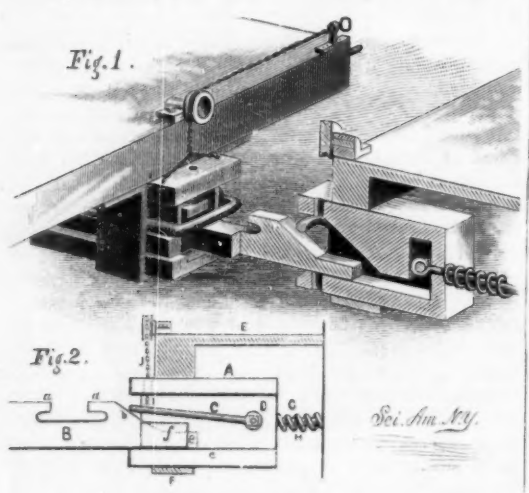
### Volcanic Ashes from Java.

To estimate the possible quantity of ashes required to give the red tint observed in the sky, let us assume that an inch of ashes is spread through ten cubic yards of air. This gives a dilution of 155,000 times. Astronomers tell us the cause of the red light reaches 60 miles high in the air. At the rate of diffusion of the ashes that is assumed, this would require a mass of 42 miles cube, or a pile of ashes 1 mile high, 42 miles wide, and 1,700 miles long.

Montclair, N. J. M.

### IMPROVED CAR COUPLING.

The drawhead, A, is attached to the platform of the car by irons, F, and drawhead rod, G, which is provided with buffer springs, and passes through the rear end of the drawhead, and is secured centrally to the rod, D. The coupling link, B, is formed with hooks, *a a*, with which the bails, C, engage when the cars are coupled, and it is also formed with inclined portions, *b*, which serve to elevate the outer ends of the bails as the coupling link enters the drawheads, so that the bails will drop over the hooks and effect the coupling. To prevent the coupling link from entering too far when the cars are run together, the drawheads are made with inclined portions (shown in the sectional part of Fig. 1) in the throats, which stop the entrance of the inclined ends of the links.




McARTHUR'S CAR COUPLING.

The extreme ends, *e*, of the link are made flat and reach under the inclined portion of the heads, thus holding the link in a horizontal or nearly horizontal position. The bails are held at a higher level than the floors of the drawheads by the blocks, *f*, formed upon the outside of the heads, so that the ends of the link can pass under them.

Attached directly to the bails are uncoupling chains that pass either to the top and down one side of the car, thereby permitting the bail to be raised either from the top of the car or from the ground, or over a pulley and thence along the platform through an eye, as illustrated in Fig. 1. When it is desired to hold the bail in an elevated position, the ring at the end of the chain is caught over a peg. The operation of the coupling will be easily seen from the foregoing description in connection with the cuts, Fig. 2 being a longitudinal section. The device is automatic in its action, and there is no necessity of going between the cars in coupling or uncoupling. This invention has been patented by Mr. C. McArthur, whose address is P. O. Box 135, Jamestown, Pa.

### Straightening Hardened Steel.

It is well known that files are not usually drawn after being hardened, and that the hardening frequently springs them out of line. But notwithstanding that the files are made as hard as they can be by heat and cold water, they are readily straightened after being hardened. This operation is performed at once, as soon as the files have been dipped. The files are taken from a bath of melted lead and chilled while red hot in a tank of running water. This immersion for the instant hardens only the surfaces, while the interior is soft and pliant with heat. At this time the file may be straightened by bending over and under bars. By similar means crooks in steel arbors, reamers, and other long tools may be removed, even after they have been hardened and tempered. A cast steel saw arbor had received an offset or crook in the journal at one end just inside the shoulder. The crook was at the worse end, that next the saw, and although scarcely perceptible to the eye when the arbor was turned on its centers, it was sufficient, when the arbor was in the boxes, to throw the periphery of a two foot saw considerably out. The arbor at the bearing part was very gradually heated, not enough to change color, but to a "black heat." A V-shaped block was placed in a vise bearing against the offset side of the journal, and the vise screwed up. At the third trial the arbor came out perfectly true. A tempered reamer was straightened in the same way, the point at which it was crooked being heated by an alcohol lamp. The heat was sufficient to allow the steel to give, but not enough to start the temper. Steel that has a blue temper only, may be straightened by blows with a pony hammer on a smooth, clean anvil, the face of which should be warmed enough to remove the chill.

### A Dead Sea Serpent.

A recent bulletin of the United States Fish Commission gives an interesting correspondence relative to a very peculiar fish—something perhaps between an eel and a shark—that was caught, but not kept, by a Maine fisherman in 1880. It has been frequently referred to as "sea serpent," was 24 feet long and 10 inches in diameter, with tail like an eel and skin like that of a shark, but finer. There were two fins, one on either side, a little back of the head, with a dorsal fin between them. The fish was dead when caught, but had torn the nets badly. Prof. Baird expressed great regret that it was not landed and kept as a remarkable specimen.

### STEAM LOG SETTING APPARATUS FOR SAW MILLS.

The engraving shows an apparatus by which the sawyer is enabled to gear the log shifting devices of the carriage, by a shaft operated by steam, located alongside of the carriage, to enable him, by operating a hand lever, to shift the knees of the head blocks forward or backward at will.

The carriage ways or tracks, head blocks, sliding knees, racks, the adjusting shaft, and pinions are of the ordinary or approved construction.

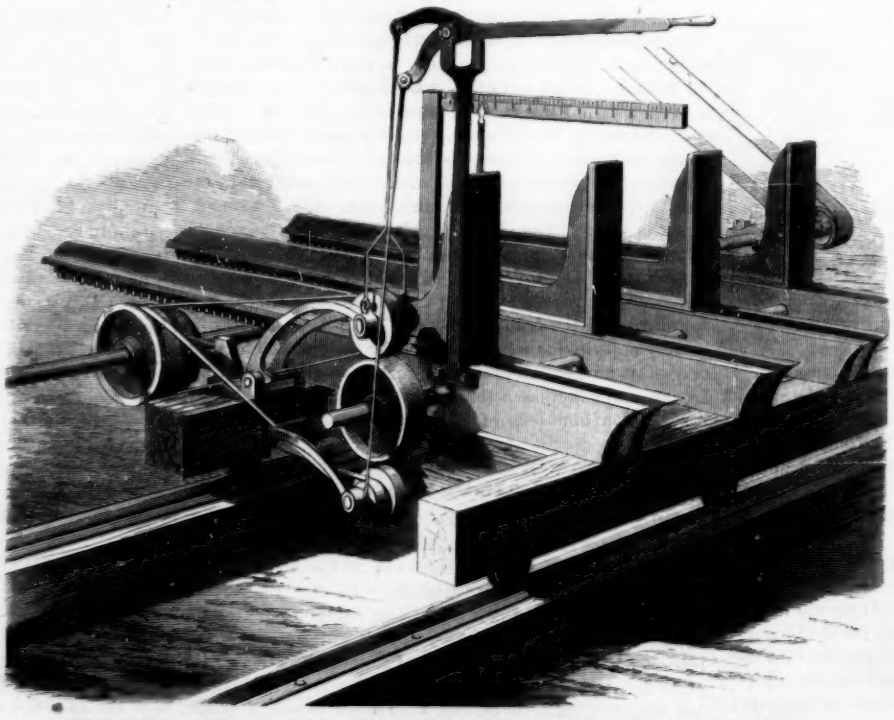
To turn the adjusting shaft and pinions by steam at the will of the sawyer, for setting up to the saw from time to time, and for shifting the knees back when a new log is to be put on, there is arranged a long shaft at the side of the carriage, at the back, supported its length by swing bearings, which are tripped automatically by a trip plate fixed on the carriage to allow the double pulley to slide on shaft, said bearings being weighted, again assume a normal vertical position under the shaft, which prevents the shaft from centrally swagging and wabbling.

On short mills this shaft is revolved continuously by a belt from any suitable driving pulley, while on long mills there is arranged an automatic belt shifting device, which shifts the belt from a loose to a fixed pulley just before the setting device gets back to sawyer, engaging the set works, which again automatically shifts belt on to loose pulley after the log has been set and the carriage started forward again.

On this shaft there is arranged a double pulley which travels along it with the carriage, the pulley having a feather or key running in the groove of the shaft, so that it may revolve with the shaft so as to drive the friction pulleys journaled in the swinging frames above, and below a friction pulley on the log adjusting shaft. The lower pulley is driven by a straight belt, the upper one by a crossed belt for reversing the motion, or *vice versa*.

The pivoted frames carrying the friction wheels are suspended from the hand lever at the top of the first knee rods, so that by shifting the lever in one direction one of the friction wheels will be made to drive the friction wheel on the adjusting shaft in one direction, and by shifting in the other direction the other wheel will drive it the other way; while in the middle position both wheels will be disconnected and the wheel on the log adjusting shaft will be inoperative and locked. A scale is so located with reference to a pointer on the first knee as to gauge the movements of the knees. The accuracy of the setting is accomplished by using a Reppard or some other suitable press roller, which is set to any size desired by the sawyer; and by pressing on the hand lever the log is brought up to the roller, thus putting the setting in the hands of the sawyer. With an apparatus of this kind the setting of the logs is simplified and at the same time it can be accurately and quickly accomplished, and the services of a setter dispensed with. This invention is covered by two patents by Mr. Walter P. Scofield, of Hawthorn, Fla.

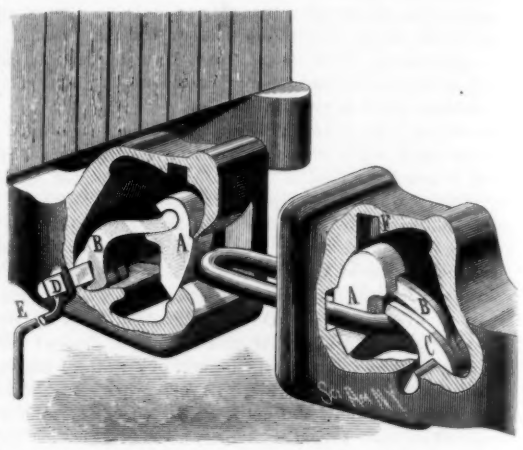
For further particulars, address Messrs. Scofield & Bailey, at the same place.



SCOFIELD'S STEAM LOG SETTING APPARATUS FOR SAW MILLS.

### IMPROVED CAR COUPLING.

A large space is formed within the drawhead to receive the pin, A, and allow it to move up and down in coupling and uncoupling the cars. The forward and upper sides of the space are curved in the arc of a circle, and the forward side of the pin is correspondingly curved. Upon the forward side of the pin is formed a shoulder which rests against the draw head at the upper side of its throat, when the pin is down, in order to prevent the pin from rising when in use. An arm, B, is inserted in a socket in the upper rear part of the pin. The rear part of the arm is curved downward, and has a semicircular hole formed through it to receive the shaft, D, which passes through a round hole in the draw head. The hole in the arm, B, is made larger than the shaft so that the latter can have a slight rotary movement within




STAMP'S CAR COUPLING.

the hole. The hole in the drawhead is made larger than the shaft, so that the entire draught strain will come upon the forward part of the drawhead. To the end of the shaft, D, is attached a crank, E, the shaft of which is made of such a length that the arm will be about in line with the side of the car, in order that it may be operated from the side of the track.

Beside the arm, B, is placed the arm, C, which has a semicircular hole in its rear end to receive the shaft, D. This arm is curved forward, and is made of such a length that its forward end will rest upon the inner end of the link. With this construction, by a slight movement of the crank the outer end of the link can be raised more or less, the enlarged hole in the arm, B, allowing this to be done without moving the pin, A. When the cars are run together the entering link strikes the pin and pushes it back far enough to free the shoulder from the drawhead, and then forces the pin upward and passes its lower end, when the pin drops through the link. In the lower side of the drawhead is an opening large enough to permit the passage of the pin and its arm, thus facilitating repairs. In the upper part of the drawhead is a cylindrical recess, F, extending nearly to the top. In case the parts should break, and no duplicates be on hand, the metal above the recess can be broken away and coupling made with an ordinary pin.

This invention has been patented by Mr. William Stamp, of Susquehanna Depot, Pa.

### Alcohol in a Bushel of Grain.

Grains of the different kinds produce alcohol in about the following proportions: Corn affords 40 pounds of spirits of the specific gravity of 0·9427, containing 45 per cent of absolute alcohol for each 100 pounds of grain; wheat, 40 to 45 pounds of spirits; barley, 40; oats, 36; rye, 36 to 42; buckwheat, 40. Now, 40 pounds of such spirits equal 3½ (3·5) gallons of government-proof spirits. Taking corn at 56 pounds per bush., rye at 56 pounds, wheat at 60, barley at 48, oats at 33, and buckwheat at 52, these grains should afford the following quantities of proof spirits per bushel: Corn and rye, each, 1·96 gallons, or almost 2 gallons; wheat, 2·1 gallons; barley, 1·68 gallons; oats, 1·12 gallons; and buckwheat, 1·82.

### Crystalline Oxygen and Liquid Nitrogen.

From a very brief report of a communication made by M. Debray to the Academie des Sciences we gather that some new facts relating to the liquefaction of nitrogen have been brought forward. Oxygen had been liquefied by being submitted to great pressure, and when this pressure was suddenly withdrawn the lowering of temperature was so great that crystals of oxygen appeared in the liquid mass, and the nitrogen in contact with the oxygen assumed the liquid state.

### The Red Sky Explained.

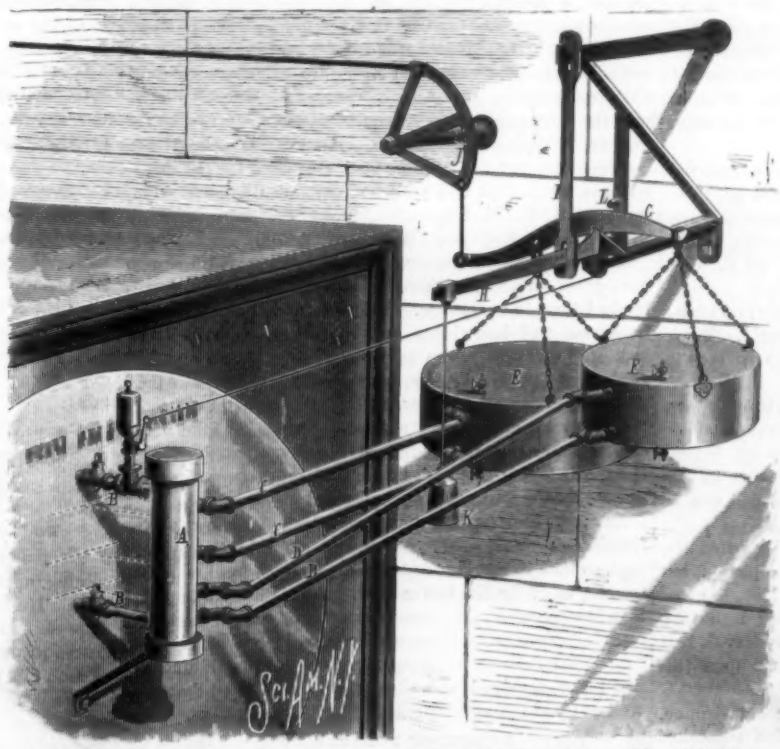
The red afterglow that has caused so much discussion among philosophers is now explained by a correspondent of the SCIENTIFIC AMERICAN, who asserts that the phenomenon is due to the red spot from the planet Jupiter. This great rosy cloud disappeared several months ago from the atmosphere of Jupiter, has had just time, according to this correspondent, to travel to our earth, and is now hovering over us, causing the ruby coloring of our skies night and morning. Nobody ever has or will be able to prove that this is not the fact; therefore, it must be true, says the correspondent. The question is settled; it is useless to talk further about cosmic dust, Java ashes, or aqueous vapor.

### FEED WATER REGULATOR AND ALARM.

The device shown in the accompanying engraving is a combined feed water regulator and low water alarm for steam boilers; the supply of water to the boiler is automatically regulated, and, in the event of the water falling dangerously low, a whistle sounds the alarm. The dotted lines, B B, indicate the different water levels in the boiler, the upper line representing the highest water level, and the lower line a dangerous level. Two closed vessels, E F, are suspended from a beam, G, upon opposite sides of its fulcrum. When arranged at like distances from the fulcrum they should be made of different sizes; thus the vessel, E, should have twice the capacity of the other, so that when it is half full of water it will balance the other when full. The beam, G, is fulcrumed near the end of another beam, H, which works on a fixed fulcrum. The other end of the beam, H, has attached to it a weight, K. A closed upright pipe, A, is connected above and below, by branches, with the steam and water spaces of the boiler. This pipe is connected at different elevations, by flexibly jointed pipes, C C, D D, with the upper and lower portions of the vessels, E F. The arrangement of these pipes and their position in regard to the water levels in the boiler are clearly shown in the engraving. The flexibly jointed connections of the pipes provide for a rising and falling motion of the vessels, E F. The vessel, E, will be about half full of water when the level of the water in the boiler is at its medium height. The alarm vessel, F, connecting both above and below with the pipe, A, at or about the danger water level in the boiler, will then and at all times, excepting when sounding an alarm, be kept full of water by the pressure of steam in the boiler, and will balance the vessel, E, when only half full.

As the water in the boiler falls below the medium level sufficiently to empty the feed regulating vessel, E, of water, the alarm cylinder, F, will fall while the other rises, and the beam, G, by means of crank rod and lever connections or by other suitable mechanism, will operate the injector or cock connected with the water supply pipe so as to feed water to the boiler. When the water in the boiler has reached its highest level the upper pipe, C, will be immersed at its connection with the pipe, A, and the pressure of steam will cause the vessel, E, to become full of water. It will then be heavier than the cylinder, F, and will fall, and in its operation of the beam, G, will cause the mechanism connected therewith to shut off any further supply of water to the boiler. In case the supply of water fails from any cause, so as to fall to the lowest safe water level, then the cylinder, E, will be emptied of water; and as the water descends so as to bring the connection of the pipe, A, with the pipes which lead to the cylinder, F, a little below the level of the water in the boiler the cylinder, F, will also be emptied. This will remove so much weight from the end of the beam, H, on which the beam, G, rests, as to cause the weight, K, to tip the beam, H, when the lever of the whistle is opened, and attention called to the dangerous level of the water in the boiler. A rest on the beam, H, prevents either vessel from falling too low in the operation of the apparatus. The vessels are fitted on their tops with cocks to provide for the escape of air and also with cocks in their bottoms for blowing off any mud that may collect in them. The inventors state that this apparatus has been in practical operation for some time and has given perfect satisfaction.

This invention has been patented in this country, and a patent has been applied for in England, by Messrs. Johnston & Brown, of 127 Pastorius Street, Germantown, Philadelphia, Pa.



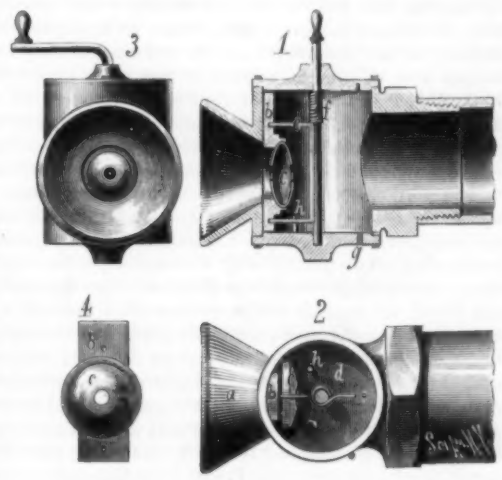
JOHNSTON & BROWN'S FEED WATER REGULATOR AND ALARM.

### The New Atlantic Telegraph Cables.

Mr. John W. Mackay has written to the London *Times* saying that the first of the two new cables being made is expected to be laid and ready for business in June, and the other during the year. He says they do not contemplate making a war of rates on the existing system, but will establish slightly lower charges and a more prompt service. The secretary of Messrs. Latimer Clark, Muirhead & Co. says the right has been purchased to use the Muirhead patents for the duplex working of the cables, whereby the effective power of transmission will be practically doubled.

### SPEAKING TUBE MOUTH PIECE.

The accompanying engravings represent a mouth piece for speaking tubes that is so constructed that the least current of air in the tube will blow the whistle. Fig. 1 is a longitudinal sectional elevation, Fig. 2 is a plan view of the same, Fig. 3 is a front, and Fig. 4 a rear view. The mouth piece is screwed to the end of the speaking tube. The casing is provided with removable top and bottom pieces in which a vertical spindle is journaled, whose upper end has a crank handle. A spring, *f*, having one end secured to the spindle, is wound around the spindle, and has its upper end fastened on the under side of the top plate. From the spindle project two arms, *h e*, on whose outer ends is an upright piece, *b*, which is provided with a central aperture,



THOMAS' SPEAKING TUBE MOUTH PIECE.

and has its outer surface rounded transversely to fit closely against the inner surface of the cylindrical casing. A whistle, *c*, of the usual construction is held over the aperture. The movements of the arms are limited by studs on the bottom piece of the casing. The piece, *b*, is held loosely on the ends of the arms, thereby preventing its curved surface from working with too much friction against the inner surface of the casing; and if there is any lost motion between the piece and the casing, the pressure of the current of air in the tube will press the piece against the casing, thus preventing an escape of air and causing the whistle to be sounded by the least current. The spring holds the whistle across the inner opening of the bell mouth; and when the tube is to be used for speaking, the piece carrying the whistle is swung to one side by means of the crank handle. The water that accumulates in the casing flows off through the hole, *g*.

This invention has been patented by Mr. William Thomas, who may be addressed for further information, P. O. Box 529, Pittston, Pa.

### Car Brake Contest.

Mr. William Loughridge, of Baltimore, the patentee of a number of car brake improvements, has commenced a suit in equity in the United States Circuit Court, Pittsburg, against the Westinghouse Car Brake Company for infringement of Mr. Loughridge's system of operating car brakes patented in 1864 and 1873. A large interest is involved, and the suit is likely to be long and costly.

### Lathe Spindles.

The old time method and the present usual way of making a lathe spindle is to first drill for the center, ream it to the taper, turn and fit the steel center, and use this steel center for one of the points of suspension in the turning and finishing until the arbor is in place in the stock. It has been found, however, that after all was done the center of the head arbor (the revolving spindle) could be seen to be out of true in its projecting length. This error was—and is—usually remedied by taking a light finishing chip from the center while it revolved with the spindle in the lathe head boxes; but the source of the error remains—a lack of coincidence between the center hole and the spindle bearings.

A better way is this: The lathe spindles now are generally hollow—all engine lathe spindles. They are of steel, and as they come from the forger are centered and end-squared. They are then chucked, drilled from end to end with a twist drill, and reamed to size by a half round drill. Nothing is done for the reception of the center, but the spindle is swung, and turned, and absolutely finished by the hole that goes through from end to end. When the spindle is finished and fitted and put into its bearings the center seat is reamed out with the taper reamer, and the steel center is fitted. It is always absolutely true by this method.

### Beef Juice vs. Beef Tea.

Prof. Roberts Bartholow, of the Jefferson Medical College, says: "Nothing has been more conclusively shown than that beef tea is not a food. It is nothing more than a stimulant. The chemical composition of beef tea closely resembles that of urine, and it is more an excrementitious substance than a food.

"In preparing beef juice, the lean part of the beef should be selected. This should be cut into thick pieces about the size of a lemon squeezer. The pieces should be next placed upon a hot coal fire for a moment, to scorch the exterior; the meat is then transferred to the lemon-squeezer, which has been warmed by dipping in hot water, and the juice pressed out and allowed to flow into the glass, which has also been heated. The juice is seasoned with a little salt and Cayenne pepper, if the patient desires it, and taken immediately. In this way the nutritious elements of the meat are obtained, and the slight scorching develops constituents which give the peculiar flavor to cooked meat." This is for a diet, the principle of which is the administration of those elements which are disposed of in the stomach, and do not require the aid of the intestines in their digestion.

### Hard-Riding Cars.

A Western car builder not long since put a new passenger car into service in the suburban traffic of his road, and not long after was taken to task by the general manager because the car was a hard-riding one. Although it was to all appearances like a number of other cars of the same class that had been built by the road, yet there was no question as to the unsatisfactory nature of its riding qualities.

Complaints from the patrons of the road became so frequent that the car was taken out of service and sent to the shops to see if the cause of the trouble could not be discovered and remedied. The running gear was examined and overhauled and a new set of springs put in. The car was again put on the road, but without any perceptible improvement in its performance. The complaints were renewed, and the car was again taken to the shops and a second set of springs put in, including both elliptics and equalizers, but with no better success.

The superintendent and master car builder made repeated trips in the car, but without obtaining even a clew to indicate the real cause of the difficulty. As a last resort, the car was provided with a pair of trucks that had been running under an easy-riding car, and then there were no more complaints about the hard riding.

The fault was evidently somewhere in the trucks, and in order to settle this point beyond dispute, the trucks that had been taken out were put under a car that had always ridden well, and on the first trip it was found to ride as hard as the first named car. A new wheel-grinding lathe had just been put into the shops, and the wheels of the defective trucks were trued up. The cause of the trouble was soon revealed. All, or nearly all, of the eight wheels were found to be out of round, the eccentricity in some of them amounting to an eighth of an inch.

This incident shows the importance of thoroughly testing the accuracy of wheels before putting them in service, and also illustrates the peculiar and unsuspected difficulties car builders have to contend with in their efforts to serve their employers and the public.—*Nat. Car-Builder.*

A WRITER in *Hygiene Pratique* states that boots and shoes may be rendered waterproof by soaking them for some hours in thick soap water. The compound forms a fatty acid within the leather and makes it impervious to water.

## END OF THE JEANNETTE EXPEDITION.

[SEE FRONTISPIECE.]

The curtain is about to fall upon the sad tragedy of the Jeannette expedition. This enterprise, begun five years ago under such very auspicious circumstances with everything to aid it that human intelligence and worldly wealth could furnish, will soon celebrate its mournful failure in the funeral of the gallant leader who sacrificed his life, his all, to the cause of discovery and science. The bodies of Capt. De Long and his companions are now on the ocean, and in a few days will be received with civic and military pomp, and laid away to rest amid the tears of a sympathetic and appreciative country.

The 8th of July, 1879, was a gala day at the Golden Gate of San Francisco. The Jeannette was setting sail "for that strange land beyond whose bourn," it may almost be said, "no traveler returns." Previous Arctic expeditions had left the region north of Behring Strait comparatively unexplored, while the seas north of Europe and Iceland and about Greenland had often been the subject of the explorer's attention, and too often had proved ultimately to be their graves. Here was a new field, however, and the opportunity was by no means to be lost. The object of the expedition was to pass Behring Strait, touch at Wrangell (or Kellett) Land, determine the character of this unexplored region, whether it were continent or island, and, if the latter, sail due north in search of that open Arctic Sea so long the object of Arctic research, and which occupies, or is supposed to occupy, that mysterious portion of the map marked "unexplored."

On the side of Behring Strait no ship had ever reached a higher latitude than 78°, while on the other side of the globe Capt. Nares, in 1875, coasting along the western shore of Greenland through that expansive strait known as Smith's Sound, had attained the highest latitude ever reached by man (of which there is any record), namely, 83° 10′ 26″ north. However great this achievement may appear, this hardy explorer had 410 miles of ice between him and the Pole.

The Jeannette, 420 tons, was formerly the Pandora, one of the steam gunboats of the Royal Navy, and was fitted out for this expedition by Mr. James Gordon Bennett of this city. The latter deemed it to the advantage of the expedition that the Jeannette should be officered and manned from the United States Navy, and the following officers whose names are now so famous were selected: Capt. De Long, commanding officer; Lieut. Chipp, executive officer, Lieut. Danenhower, navigation and ordnance officer; Dr. Ambler, Surgeon; Chief Engineer Melville; Ice Pilot Dunbar; Mr. Newcomb, collector of specimens and taxidermist; and Mr. Collins, meteorologist and scientific observer. There were 32 souls on board all told, and the ship was provisioned for a 3 years' cruise.

After leaving San Francisco, the Jeannette touched at St. Michaels, in Alaska, where 40 dogs and 2 drivers were added to the ship's equipment. After leaving the Strait, Wrangell Land was the point of destination. This proved to be a rather insignificant island. Soon after leaving this island an ice pack was met with, and on the night of September 30, 1879, the ship was frozen in. Herald Island was soon passed, and then there was a tedious period of 21 months of drift. For the first 5 months only 40 miles were made, and Wrangell Land was often visible 75 miles distant. After this the drift became very rapid.

During this period of drift several islands were discovered and named. Jeannette Island was sighted on May 16, 1880, in latitude 76° 47′ N., 158° 58′ E. This island was quite small, and was not visited. On May 27, Henrietta Island was sighted in latitude 77° 8′ N., longitude 157° 32′ E. This is quite a large island, as is also Bennett Island, in latitude 76° 38′, longitude 148° 20′. On the shore of this last island were found specimens of drift coal and old horns. There were no seals or walrus, although birds were to be seen in abundance.

The temperature ranged from 44° above zero to 58° below. During the first summer the mean temperature was 40° above zero. During first winter mean temperature 33° below; while during second winter mean temperature was 39° below zero. The greatest velocity of wind recorded was 50 miles an hour.

For nearly two years nothing was heard of the Jeannette, and during all this period she was drifting helplessly, but surely, to destruction. On the 11th of June, 1881, the end came, and the Jeannette was crushed to dust beneath a mountain of ice from one of those sudden upheavals that had so often threatened her during her sojourn upon this floating island.

Fortunately, De Long had anticipated the catastrophe. He divided the crew into three parties, which embarked immediately in the small boats, No. 1 carrying De Long and Dr. Ambler, No. 2 being officered by Lieutenant Chipp, and No. 3 officered by Chief Engineer Melville, Danenhower being compelled to give up the command, owing to the terrible suffering he experienced from the loss of his eye.

The Jeannette met her fate in latitude 77° N., longitude 157° E., near New Siberia Island, 500 miles from the mouth of the Lena.

As is well known, the three boats separated from one another during a fearful storm on the night of September 12th. Four days later Melville's boat reached land at Byko, 40 miles south of Cape Barkin, near a mouth of the Lena. De Long landed at another mouth of the Lena at about the same time, but unfortunately the land was completely uninhabited and he found the much longed for terra firma as little a place of rest and safety as the snows and ice of the Arctic seas. The unfortunate Chipp and his crew have never been heard from, and the probability is that they, like the gallant seamen which they were, found their graves in the ocean depths.

Melville, ever forgetful of self and faithful in duty, has no sooner placed the unfortunate Danenhower in a place of safety than he starts with a supply of provisions and with native guides in search of his missing companions. Week after week he continues the search, and finally discovers tracks and instruments, and then he comes across the guides Noros and Ninderman, who had been sent forward for assistance. With untiring effort and the assistance of these guides, the party at last were successful in finding the location of the last bivouac. De Long was lying with his feet toward the fire, with his diary by his side, and with his pencil dropped from his fingers. The delicious rest of that sleep which precedes death by freezing had overtaken him in the act of making an entry in that sad record of his sufferings. His companions were round him in more or less close proximity. On April 7, 1882, the bodies of the whole party were buried in a common grave, with simply a pile of stones and a single cross to mark the spot of their interment.

Here they rested until arrangements had been completed for transporting them to America. During the winter of 1882–3 the bodies of De Long, Dr. Ambler, Mr. Collins, and two others, were transported to Yakutsk, in Siberia, the other bodies being left till the following winter, owing to the impossibility of procuring enough dogs and sleds for the transportation of all the remains. The journey from Yakutsk was commenced on sleds on November 28, 1883, and Orenburg, the eastern terminus of the railroad to Moscow, was not reached till January 17, 1884, the whole distance traversed by the sleds being 5,761 miles. All along the route of travel, from the most obscure villages of Siberia to the gayest capitals of Europe, peculiar and special honors were paid to this solemn funeral cortege. The Frisia, from Hamburg, which has the honor of bearing the bodies of these heroes upon their last voyage, is due at New York in a few days. A military escort will receive the bodies and accompany them to the Navy Yard, where they will lie in state. A naval representation will have position immediately about the hearses as an appropriate funeral escort, and will probably be preceded by United States troops and State militia. The following organizations will form in line: Battalion of the army, the battalion of the navy, 23d regiment, N. G. S. N. Y., 69th regiment, N.G. S.N.Y., Grand Army of the Republic, the Geographical Society, New York *Herald* Club, officers of school ship St. Mary, Officers of Navy, and classmates of Lieut. Com. De Long, survivors of Jeannette and other Arctic expeditions.

## On the Manufacture of Sulphuric Acid from Pyrites in the United States.

BY F. L. BARTLETT, PORTLAND, ME.

It is not generally known that pyrites is now extensively used for making sulphuric acid in this country. It may, however, be stated for a fact that fully two-thirds of the acid manufactured at the present time is made from pyrites. Prior to 1882 only two concerns were using pyrites for acid making; now at least eighteen firms are using pyrites ore, while many others are either preparing to use the ore or have the matter under grave consideration. Of the larger concerns now making use of pyrites may be mentioned the Pennsylvania Salt Co. and the U. S. Chemical Co., of Pennsylvania, the Laurel Hill and Bergenpoint Chemical Companies of N. Y., the Cochrane Chemical Co., and the Bradley and Barker Fertilizing Works, of Boston.

Many attempts were made some eight or ten years ago to use pyrites for acid in different places in this country, resulting in failure in every case. This was undoubtedly caused, not by want of knowledge on the subject, so much as by lack of proper material to work upon; zinc blende and low grade earthy pyrites were then used, containing not more than 30 or 35 per cent of sulphur, and of this amount not more than 15 or 20 per cent was available for acid. Like many other chemical industries, the manufacture of sulphuric acid is imported from England, where acid has been made from pyrites for the past twenty years.

As might be expected, the introduction of the use of pyrites in this country at once caused a fall in the price of acid, so that now acid may be obtained almost as low in this country as in the English market. From the fact that acid is so largely used in the manufacture of chemicals, and more especially fertilizers, it follows that cheaper sulphuric acid cannot fail to exert an immense and a beneficial influence upon the chemical manufactures of the United States as well as upon the agricultural industries.

### SOURCES OF PYRITES SUPPLY.

Since the demand has arisen for pyrites in this country, America has shown herself equal to the occasion by unearthing several good deposits of pyrites. Especially is this the case in the Southern States, where acid is much in demand for the manufacture of superphosphates. Several good deposits occur in Virginia and South Carolina, containing ore fully equal to the famous Spanish pyrites. In the New England States are several deposits, but two only are now worked extensively for pyrites, namely, the Milan Mine, of Milan, N. H., and the Davis Mine, of Charlemont, Vt.; both of these mines are successfully worked on a large scale, and the product finds ready sale. Considerable ore comes from Canada, being mined at Capelton, P. Q. There is also an inferior ore mined at Ogdensburg, N. Y., which is used to some extent in the West; there are also deposits in New Hampshire, at Lisbon and Thetford, not, however, now worked for acid making. The competition now most strongly brought to bear against the American ore is that of the Spanish mines Tharsis and Rio Tinto. Ore is shipped here in large quantities, and actually sold for a less price than in England, and it is a noteworthy fact that the American acid makers are enabled to-day to buy ore for less money than their English cousins.

As to the quality of the ores great variation is noticed; the following table gives the range of the most notable constituent parts in each ore now in use:

| | Spanish Pyrites. | Milan. | Davis. | Capelton | Ogdensburg. |
|---|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Sulphur | 46·00 to 49·00 | 44·00 to 50·00 | 42·00 to 49·00 | 40·00 to 42·00 | 30·00 to 35·00 |
| Arsenic | 0·25 to 0·80 | traces. | traces. | 0·20 to 0·50 | unknown |
| Copper | 2·00 to 3·50 | 2·25 to 4·00 | 1·00 to 2·00 | 3·00 to 6·00 | none. |
| Silica | 1·5 to 4·00 | 2·25 to 7·00 | 2·00 to 10·00 | 12·00 to 20·00 | 15·00 to 25·00 |

It will be seen in the above table that the Milan and Davis ores contain only traces of arsenic, while the sulphur contents are fully equal to the Spanish ores, in fact, acid made from these two ores is practically free from arsenic, and ranks as well in the market as acid made from the best Sicilian sulphur. In the matter of making fertilizers, however, arsenic is no hinderance.

In burning the ore several points must be taken into consideration; the ore must yield its gas easily and strongly without sintering in the kilns; it must be somewhat granular, yet not have a tendency to crumble or break down in the kilns; moreover, it must give a good yield of acid. Most of these ores will burn down to four per cent of sulphur left in the cinder, and that may be considered good work. No trouble has yet been experienced in this country in making acid from pyrites, and it is safe to say that within a short time about all sulphuric acid makers will use pyrites. There is one concern already established at Elizabethport, N. J., for the treatment of the cinder resulting from burning the pyrites. This cinder is treated for the copper and the small amount of gold and silver contained in it, by net extraction; the residue, or "blue billy" as it is called, is used to some extent by the rolling mills as a "flux" in the puddling furnaces. The greater part of the cinder is, however, now thrown away. This cinder, by the way, is a perfect flux for smelting any kind of silicious copper, silver, or gold ore, and were it not for excessive freights would soon find a market in the West for smelting purposes. On the whole, it may be said with truth that acid making from pyrites is now firmly established in the United States.

## Weighing Milk.

To those who have no lactometer, or who find difficulty in reconciling its readings with their experiences in judging of milk, it may be interesting to know that a quart of good milk should weigh about 2·15 pounds, or nearly 2 pounds 2½ ounces. Water, at 60 degrees Fah., weighs 2·0885 pounds. Of course, skimmed milk shows a heavier gravity, in proportion to the amount of cream taken off, as the addition of water also lightens the milk. Weighing milk will give the monthly yield in quarts more exactly than measuring. Probably not one farmer in ten has any definite idea as to the average yield of his cows in pounds or quarts. Those who have never tried keeping a record of the milk yield will find it a profitable and perhaps a surprising experiment. One thousand pounds of average milk contains:

| | |
|---|---|
| Casein | 33 pounds. |
| Fat | 36 pounds. |
| Milk sugar | 45 pounds. |
| Mineral matter | 7 pounds. |

## To Determine the Adhesive Power of Glue.

Weidenbusch has devised a practical method for determining, approximately, the adhesive power and quality of glue. He first prepares a set of plaster prisms by mixing gypsum and water together in the proportions of one to five. These prisms are 9·2 cm. (about 4 inches) long, with a cross section of 4 millimeters (⅛ in.), and each weighs 1·7 grammes (26 grains).

The glue solutions were made from 1 part of glue in 25 parts of water, and the plaster prisms soaked in them for 5 minutes, then dried in the air. Each is then placed on a horizontal iron ring in such a position as to form its diameter, and from its center is suspended a pan in which weights are placed until it breaks. The strain it can withstand is proportional to the adhesive power of the glue.—*Deut. Industrie Zeitung.*

## Silk Exhibition.

A silk industrial exhibit, to cover the agricultural, mechanical, and manufacturing interests of that industry, is to be held in Philadelphia, continuing two weeks from April 21. The co-operation is invited of culturists, manufacturers, art schools, and all those who have odd or curious articles of old or new designs. The Serrill automatic reel, brought from Lyons, and constructed by a young American inventor, will be shown in operation.

## Correspondence.

### Bread Alcohol.

*To the Editor of the Scientific American:*

Referring to No. 2, c. s., of your esteemed paper, Mr. N. D. Portland wrongs the "Brandy Bread Company." Any bread, the dough of which is only affected by saccharine fermentation, might prove sweet, there is no doubt, but the average human stomach could not stand such food. Even the "vinous" part of that mysterious process of fermentation is an act of importance to the bread. One part of the sugar must be decomposed, giving alcohol and carbonic acid, the development and expansion of which raise the dough and give it a sponge-like appearance and structure. As this process is going on until stopped by the heat of the oven, it is evident that a certain quantity of said ingredients escape through the chimney. Whether the quantity of escaping alcohol is sufficient to pay the expenses of condensation and refinery is a matter of experience.

JOSEPH HAMPL, Troop L, 8th Cavalry.

Fort Clark, Texas, January 25, 1884.

### Movements of Cyclones.

*To the Editor of the Scientific American:*

In July, 1868, with other residents of State Center, Iowa, I witnessed the progress of a cyclone. There had been an extraordinary fall of rain from 1 o'clock P.M. to 2 o'clock P.M., which, stopping suddenly, business men came out doors, and their attention was called to a water spout in the southern heavens. When first seen it was south, about 50° above the horizon, cone shaped, base up, 3° to 5° in height, black and forbidding, rotary motion discernible and of fearful velocity, progressive motion from southwest to northeast. It disappeared behind a cloud about east, and was visible about ten minutes. During its progress it careened like a balloon as if top heavy. Part of the time it was a truncated cone, and then at the smaller and lower base it would lengthen out to a point, and once to an attenuation that twisted and whipped around like a rope. Its nearest approach to State Center was judged to be six miles, probably too much, as that distance would require a progressive motion of a mile per minute. It seemed to follow the irregular margin of a light colored bank of cloud lying beyond and below a darker, heavier, and higher bank.

I have since been on the tracks of several hurricanes—the Camanche hurricane which started at Camanche, Iowa, and traversed Whiteside and Lee Counties, Illinois; another was a cyclone of tropic proportions, that swept the sugar plantations of Louisiana, particularly Bayous, Tiche and La Tourche. Two in the floor-like bottom of the Mississippi in Tennessee, where the tangled masses of felled timber, ten to fifty rods wide, and miles long, are known as hurricanes. Another at Ripley, Tennessee, I was in; another at Brown's Island, in the Upper Ohio; and lastly, one at Gumtown, Warren County, Ohio. In each case I have taken some pains to observe and to learn from witnesses the habits of this violent phenomenon. In every case they harmonize with the general features as given in the books, the water spout of State Center being a miniature of each. All, with one exception, confirm the "Practical Hints Regarding Tornadoes," by John D. Parker, as in your issue of November 17, 1883. The exception is the cyclone of Louisiana, which was so large that several hours elapsed while the calm center was passing. At Baldwin, old brick sugar mills that withstood the first storm yielded like potter's clay to the second, and a guard that would have been theoretically right as against the first would have been exactly wrong for the second.

JOHN B. HOLBROOK.

Lebanon, Ohio, February 4, 1884.

### Skillful Surgery.

Bruno Knorr shot himself, in this city, on the 24th ult., the bullet, of 32 caliber, piercing his skull just on the central line between the eyes. Dr. W. F. Fluher, one of the consulting surgeons of Bellevue Hospital, and Dr. Robert P. Morris, the house surgeon, probed for the bullet, and found that it had passed through the brain, taking a course slightly upward and to the left. It was impossible to remove the bullet by the way which it had entered, and Dr. Fluher decided that the best thing to do was to cut a hole through the skull at the back of the head where the bullet was lodged, and get it out that way. The difficulty was in determining the exact location of the bullet. Dr. Fluher, by means of the probe, got the general direction that the ball had taken, and formed his judgment by it. The hair was cut from the back of Knorr's head, and a hole the size of a cent was cut through the skull. The instrument used was a trephine, which is a cylindrical saw with a handle like that of a gimlet. It was placed against the skull and worked round and round until a circular hole was cut. The bullet was removed through this hole. A rubber drainage tube was then passed through the brain, its ends projecting an inch through the hole cut by the bullet and an inch through the hole made by the trephine. The operation, which was witnessed by nearly the whole staff of the hospital, lasted four hours. On the following Saturday and Sunday the patient was stupid and partially unconscious, but at times he gave monosyllabic answers to questions. Monday he was much brighter, and could talk and feed himself. His right arm seems to be paralyzed. Hopes are entertained of his ultimate recovery.

### German Parcel Post.

In respect to the transmission of parcels the German postal service far surpasses that of most other nations, and an enormous business is done in this way by the post office department. Packages of less than 10 pounds weight are carried everywhere for 12 cents, including delivery at the house of the consignee. It is amusing to find that the establishment of this convenient system has fostered the growth of a large business in certain products, those particularly noted being butter and smoked herrings. Butter is now put up for this sort of transportation of 10 pound cases, of which immense numbers are sent from North Germany to the cities; and boxes of herrings of the same weight are constantly forwarded from the sea coast towns to the interior. Last year the number of boxes of herrings passing through the mail was more than 450,000, and it is said that the fishing villages of the coast appear to be on fire from the smoke of the little fires over which each fisherman cures his herrings for this convenient market.

The business of the poor fishermen is still further aided by an arrangement under which the sender of the box, on payment of a commission of 2 per cent, can receive at once from his postmaster, in cash, the value of his consignment, the post office department taking upon itself the risk of making collections on the arrival of the package at its destination.

### Arsenic in Carpets and other Fabrics.

BY DR. F. ELSNER.

There is rarely any difficulty about the detection of arsenic in poisonous fabrics, for it is generally present in such quantities that it will not escape the notice of even an inexperienced young chemist. In many cases the quantity can be judged of approximately by Bettendorf's reaction. This is performed as follows: A weighed portion is dissolved in concentrated hydrochloric acid, free from arsenic, or, if insoluble, is extracted with this acid. As much stannous chloride as will lie on a knife blade is put into the boiling solution, and the reduction of the metal or the browning of the solution carefully noted, both as regards time and intensity. A parallel experiment is made with the tin salt and acid by adding at intervals from one to ten drops of an arsenical solution of known strength (say 1 in 1000 or 1 in 100). A little experience will make it easy to judge of the quantity of the arsenic approximately. This method is not intended to take the place of more exact methods, but only to obtain some idea of the subject, and as an assistance in subsequent analysis in the usual way.

It is much more difficult to detect arsenic is carpets and colored fabrics generally, where it is frequently present only in very minute quantities. In this case a qualitative test is *never* sufficient, even applied to a very small surface. In quantitative tests it is necessary to always work with the same quantity of reagents free from arsenic and with a convenient solution of the substance.

For many years I have been using a pure 25 per cent sulphuric acid, which penetrates all fabrics in 12 to 24 hours, at 130° to 150° Fahr., to such an extent as to remove and dissolve all poisonous arsenical compounds. If necessary, Prof. Fleck strengthens the acid by adding some nitric acid —about 3 or 5 per cent of acid with a specific gravity of 1·24. Of course this necessitates an evaporation of the solution until heavy fumes of sulphurous acid appear, so as to expel all the nitric acid before it can be put in a Marsh apparatus.

The rest of the operation, as described recently by Fleck (*Repertorium Anal. Chem.*), is so simple and elegant as to justify our giving it in his own words:

"Before beginning the operation 200 grammes of the 25 per cent acid is tested with 10 grammes of granulated zinc in a Marsh apparatus, putting in a strip of platinum foil. Another experiment is made by evaporating 10 grammes of the nitric acid with 100 grammes of pure sulphuric acid, and testing it in a Marsh apparatus. The reagents are comparatively pure if no mirror is formed on heating the delivery tube—which should be of hard glass and 2 millimeters in diameter—for half an hour, while the current of gas does not exceed 200 c. c. in 3 minutes. After being satisfied of the purity of the reagents, the article to be tested is exposed for 18 or 24 hours to the action of 50 or 100 c. c. of the sulphuric acid, then filtered, the residue washed, and the filtrate evaporated, if nitric acid was used, until this acid is all expelled in a porcelain dish; otherwise evaporation is not necessary, and the liquid can be made up to 200 c. c. At the same time a Marsh apparatus is prepared, and into it is put 10 grammes of zinc that has been tested and 20 c. c. of the solution just obtained. The gas is passed through a red hot tube, after the usual precaution, to avoid explosion, for half an hour, and if an arsenic mirror is seen, then the remaining 180 c. c. of the solution are preserved for quantitative tests. If none is observed, 20 c. c. more is added and the heating continued another half hour; this being repeated with each 20 c. c. until it is either all used up or the mirror appears.

"These qualitative tests will prove whether a quantitative estimation is possible or not. If the mirror first makes its appearance when 100 c. c. of the solution has been used, the quantity will be represented by tenths of milligrammes, and its estimation is almost impossible. But if a mirror is distinctly visible in 10 minutes after the first 20 or 30 c. c. are put in, it is safe to attempt a quantitative analysis.

"This is made as follows: The arsenic is precipitated *hot* with sulphydric acid gas, the precipitate collected on a filter, and dried in the air. It is then moistened with alcohol and the sulphur washed out with carbon-disulphide, after which it is dissolved in ammonia, reprecipitated with pure sulphuric acid, collected on a tared filter, and weighed. The result is generally rather too high, but the error is less the easier it is to remove the dye from the fabric, and the less of the latter goes into solution.

"If there is a large quantity of the arsenious sulphide, it is better to oxidize it to arsenic acid and estimate it volumetrically or gravimetrically."

[After oxidizing it can be precipitated as arsenic sulphide ($As_2S_3$), and weighed as such after removing the free sulphur with carbon-disulphide.—TRANS.]

Another process, which is very easy and accurate for small quantities of arsenic, is given by E. Reichardt (*Archiv Pharmacie*). He treats the article with dilute hydrochloric acid (1 to 5), and makes use of aliquot parts of the solution containing from 1 to 10 milligrammes of arsenic. Still smaller quantities can be used, but if more is taken part of it separates in metallic form in the evolution flask and escapes quantitative estimation.

Reichardt's apparatus consists of three thick bottomed flasks, each about 30 c. c. (1 ounce) capacity. In the first are a few small pieces of zinc covered with water, and through the cork passes a tube that dips in the water and has a funnel attached to the upper end by means of a rubber tube, so that when the funnel hangs down the tube is closed and no gas can escape or liquid ascend. Another tube connects it with the second flask, in which are 1 or 2 c. c. of argentic nitrate solution (1 to 24), the same quantity of concentrated nitric acid, and 4 or 5 times as much water. The third flask contains the same. To test the reagents one c. c. of dilute acid (1 to 5) is poured through the funnel and tube, and if this does not effect the silver solution for several minutes, a measured quantity of the liquid to be tested is put in the first flask. It must not be too acid, or the gas will go off too violently. If strongly acid, add some pure sodic carbonate. Silver will begin to separate, and when all the arsenic has gone off the solution of silver will become clear again and the metal all settle.

Bromine water is then added to the silver liquid in excess and well shaken, the bromide of silver filtered out, and a large excess of ammonia added to the filtrate, then the magnesia mixture, and let stand 24 hours. The precipitated ammonia-arsenate of magnesia is washed with ammoniacal water, dried, and ignited at a dull red heat. Of course the quantity found must be calculated to definite surfaces.

The latter part of the process is also applicable to large quantities of arsenic, as the sulphide which is obtained, mixed with sulphur, by precipitation with sulphydric acid, is easily converted into arsenic acid by bromine water, and can then be precipitated with magnesia, or introduced into the hydrogen apparatus after expelling the bromine.

I may here mention still another process which I employ when it is impossible to get colorless solutions, especially for colored varnishes—the coal tar colors, etc. In these cases I introduce weighed or measured quantities in very small proportions at a time into melted soda saltpeter, and use the solution of arsenite of sody for quantitative estimation by one or the other of the above methods.—*Chemiker Zeitung, No.* 103.

### The Last Transit of Venus.

In a lecture delivered at Cooper Union, this city, on February 9, Prof. Young, after showing in the fullest manner the many methods of measuring the distance from the earth to the sun, and detailing all that had been hoped for from the observations of the transit of Venus, concluded that this last was a disappointment. The atmosphere of Venus prevented exact observation, and the measurements made with the planet Mars, by the astronomer Gills, were upon the whole more satisfactory. When the transit of Venus came around again in 121 years, it was doubtful if the event would be hailed with much enthusiasm. The fact was becoming known to astronomers generally that the system pursued by the French scientist Leverrier, that of calculating the earth's distance by the perturbations of the moon, seemed to contain the best elements of approximation to absolute truth.

### Expulsion of Rats.

A writer in *Chambers's Journal* relates his experience in ridding his house of rats. He first tried the well known remedy of pouring tar into the entrance of their holes and also of placing broken glass by their holes, but neither remedy did he find effective. But bound to get rid of the rat nuisance, if such a thing was possible, he tried another well known remedy, which proved more satisfactory. He caught a couple of large rats in a trap alive, and then besmeared them all over, except their heads, with tar, and let them loose in their favorite run. But he says: I could not follow these two tar-besmeared rats into their numerous runs to see what would happen; but it is reasonable to assume that they either summoned together all the members of their community, and by their crestfallen appearance gave their comrades silent indications of the misfortunes which had so suddenly befallen them, or that they frightened their brethren away, for they one and all forsook the place and fled. The experiment was eminently successful. From that day, in 1875, till now, 1883, my house, ancient though it is, has been entirely free from rats, and I believe that there is no remedy equal to this one.

### Railway Electric Lights.

An interesting experiment is now being tried on the Metropolitan District Railway, London, in connection with one of the suburban trains running from High Street, Kensington, to Putney, the carriages of which are lighted by electricity direct. In carrying this out, a Siemens dynamo and a Willans three-cylinder engine are placed in a luggage van which is attached to the train. Steam is supplied to the engine by means of a small boiler, which is also fixed in the van. The carriages are lighted by means of a total of twenty-eight Swan incandescent lamps of 20 candle power each, which give a very brilliant light. The present machinery was designed for a longer train, and, in addition to the lamps in the carriages, there are about thirty in the van which are always lighted when the others are. The object of this is to ascertain the exact cost of working a sufficient number of lights for the longer trains, which are usually fitted with fifty ordinary gas lamps. The experiment is being carried out for Lord S. Cecil, general manager of the District Railway, and Mr. J. S. Forbes, chairman of the London, Chatham, and Dover Railway Company. The first public trial of the light took place recently, and the results were considered very satisfactory. It is, therefore, intended to continue the experiment for some weeks, the train being all the time in regular work. In the event of the machinery proving effective and trustworthy, it is probable that a Willans engine and a dynamo will be placed on the engine of the train, so that steam can be supplied from the locomotive boiler. This arrangement, which has been proposed by Mr. W. F. Massey, of Twyford, will necessarily prove cheaper, inasmuch as the small boiler and the special attendant in the van will not be required. It is anticipated that the cost of lighting a train by electricity direct will be much less than that of oil lamps.

### Enameling Cast Iron Ware.

Otto Holrenz, of Beresdorf, has devised a new process for preparing iron vessels for enameling. He sets out with the assertion that the enamel adheres to the white iron better than to gray, because the latter contains a mixture of uncombined carbon (graphite); hence, the articles to be enameled should be cast in iron, the surfaces of which are free from graphite. To accomplish this the mould in which the iron is cast is made of damp sand covered with a substance that will take up carbon and remove it. The best substance for this purpose is sulphur, which combines with the free graphite to form sulphide of carbon, which burns as soon as formed. Holrenz, therefore, dusts the moulds with fine sulphur powder, either alone or mixed with pulverized quartz or charcoal dust. The mixture contains more or less sulphur according to the quality of the iron used, but always has enough sulphur to convert the surface of the iron in contact with the mould into white iron.

The castings thus prepared are not pickled, as was previously customary before enameling, but the first or basic coating is applied directly to iron as soon as it has been mechanically cleaned or scoured.

A similar result is obtained by coating the mould with oil or petroleum, whereby a portion of the graphite is converted into a hydrocarbon, and this burns up when the casting is made.

Finally, to remove the graphite from the surface of an article already cast, it is coated with sulphuric acid of 60° B. and then ignited, when sulphuric acid that has penetrated into its pores acts upon the graphite as the sulphur powder in the mould does upon the fluid iron.—*Deut. Industrie Zeitung.*

### Artificial Diamonds.

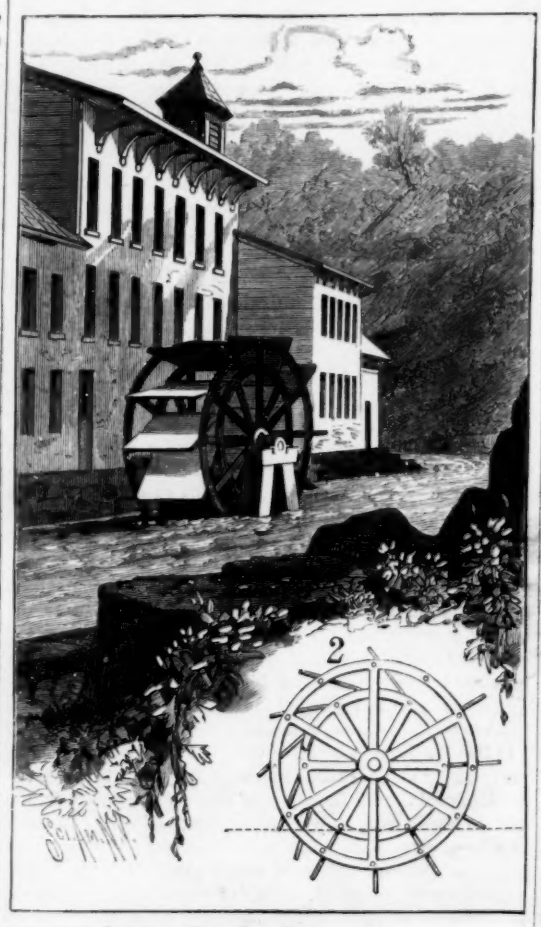
The importation of artificial gems, in which there has always been a large trade, has lately been greater than usual, a new French imitation diamond having proved quite popular. It is made of strass, a variety of flint glass containing more lead and in some cases a smaller proportion of borax, but the glass is subjected to a great heat and then plunged into cold water, whereby it is contracted so the grain becomes very close and fine. It is cut and polished like a real diamond, a leaden wheel with oil and diamond dust being used.

These artificial diamonds are called "heliolas," and are graded to conform to carat sizes of real diamonds, selling at from $20 to $50 per gross. A very small bit of foil is used as a backing, attached to the center of the back, reflecting the light into the heart of the stone. Such imitation "diamonds" are largely used for theatrical and fancy dress purposes, and in rolled plate jewelry of every form, besides being sometimes worn, it is said, by ladies owning real diamonds, and others whose financial condition has compelled them to part with their real gems. It requires the skill of an expert to determine the difference between the genuine stone and the new imitation.

A RECENT French law makes revaccination incumbent upon every student received into the lyceums and colleges. Since the experiment was made at the Lycee Louis le Grand not a single case of variola or varioloid has appeared.

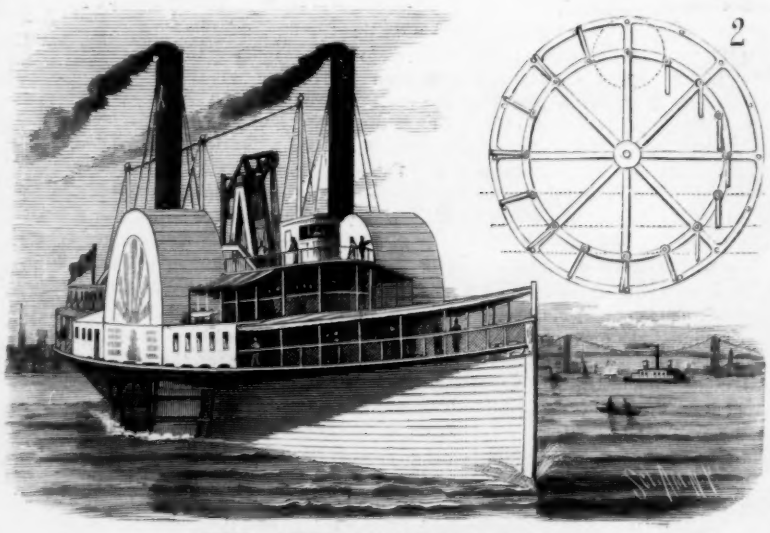
### THE DUPLEX TIDE WHEEL.

The wheel shown in our first engraving will work with equal efficiency in both directions. The plan is simple, and permits all the parts to be easily and yet strongly and durably constructed. It consists of a rigid outer wheel and a loose inner wheel provided with stops, to limit its movement, and with hinged paddles held to their work by the connecting rods of the outer wheel. To the shaft are rigidly attached the side frames of the outer wheel, the rims of which are connected by as many rods as there are paddles. Upon the shaft, at the inner side of these frames, are placed the




THE DUPLEX TIDE WHEEL.

side frames of the inner wheel, the rims of which are connected by rods, and which are kept at the proper distance apart upon the shaft by collars united by bars or by a tubular washer. The inner wheel moves freely upon the shaft, but its movement is limited by blocks (shown in Fig. 2) attached to the rims of the frames of the rigid wheel, and which engage with the spokes of the inner wheel. To the connecting rods of the inner wheel, which is made smaller than the other, are hinged the inner edges of the paddles, which project between the rods of the outer wheel. From this it will be readily seen that the wheel will work equally well in either direction, the only lost motion being the distance the stop has to travel between the adjoining frames when the current is reversed.




THE ACME PADDLE WHEEL.

THE ACME PADDLE WHEEL.

Our second engraving represents a feathering paddle wheel, in which the blades are pivoted at their inner edges to the frame, and are held to their work by stops placed in the frame radially beyond the pivots, thus leaving the blades free to revolve in a full circle as shown in the sectional drawing. By this arrangement, when the wheel is revolved in either direction the paddle will revolve in the opposite direction until it is immersed, when it will be pushed through the water by the bars, thereby propelling the vessel in the opposite direction. With slow motion the paddles will dip edgewise into the water, as indicated in Fig. 2; with extreme speed the centrifugal force will carry them outward in a straight line from the shaft. In this case they meet a countercurrent nearly equal in velocity to that of the outer rim of the wheel, and will then feather to this current until acted upon by the bars. By reversing the motion the paddles will arrange themselves to their work in the opposite direction in one-half a revolution of the wheel. The wheel may be immersed in the water nearly to the main shaft and yet it will retain its propelling power, and for this reason it is adapted for seagoing as well as river and coast steamers. In Fig. 2 the dotted line shows the path which the paddle is free to traverse. Instead of one line of paddles there may be two or three arranged upon pivots in concentric circles. The inventor has found by experiments that this wheel is greatly superior to the ordinary rigid paddle wheel.

These inventions have been recently patented by Mr. C. L. Petersen, whose address is P. O. Box 2705, Boston, Mass. Patents applied for in England, France, Germany, and Canada.

### Steel Spring Motors.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Wilfred Lewis read a paper upon the "Resilience of Steel," reviewing some of the means employed for the storage of energy, and showing the place occupied by steel among them.

Among the means now employed, compressed air, hot water, and the storage battery were cited from an English writer as being about equal in value, and as giving out about 6,500 ft. lb. of work per pound of material used.

Steel springs, according to the same writer, were said to yield about 18 ft. lb. per pound. In this connection the project of using steel springs as a motor for street cars was referred to as the most hopeless of all possible means of locomotion.

To test the accuracy of this statement in regard to steel, several experiments were made by the writer upon tempered specimens, both for tension and flexure. Contrary to expectation, the highest results were shown by the flexure of a small spiral clock spring weighing 2,040 grains, which gave out, when wound up, about 45 ft. lb. of energy, or in other words, 154 ft. lb. per pound.

The transverse strength of this steel within the elastic limit was found to be about 300,000 lb. per square inch, and its modulus of elasticity about 30,000,000. Such extraordinary strength, with such a low modulus, was so far beyond conjecture that it seemed to give a new hope for the success of the project referred to; but after making the necessary allowances for weight of car and efficiency of driving mechanism, it was found that not more than about 20 ft. lb. per pound of car would be available for locomotion. It was therefore improbable that such a car could ascend a hill over 20 feet high.

It was also a matter of doubt whether larger springs could be made to show results which would even approach these figures, and on this account the experiments about to be tried might be looked for with some interest.

### Indian Fish-Egg Food.

We are indebted to Messrs. Fulda Brothers, of San Francisco, for a fine specimen of the fish-egg food prepared by the native Indians of British Columbia. The specimen received consists of a small branch of cedar, the leaves of which are thickly coated with dried fish eggs. Our correspondent says the eggs of the specimen sent are from a small fish that abounds in the waters of Vancouver's Sound, and are collected by making a mattress of cedar twigs and sinking them in shallow places until the fish have deposited their spawn, when the twigs are raised and the spawn allowed to dry. When wanted for use, they are simply soaked and eaten.

In this connection we will give the following item from a correspondent of the Chicago *Tribune*, who tells about fish and fishing in Sitka Bay, Alaska:

Drop a hook in any of these immense stretches of inland waters, and especially amid the Alexandrine Archipelago, and in a moment a fish will be at the bait. Rock cod, halibut, weighing from 40 to 150 pounds, salmon, fill all the streams and bays; and the herring! A fish story here will be apropos. During the spring of 1881 the writer was in Sitka, and was a witness to one of the most wonderful sights in the bay of Sitka. For more than a week the water of the bay, covering an area of fifteen or twenty square miles, was as white as milk with fish spawn, extending as far as the eye could see. The herring were so numerous that people were gathering them from the water along the beach with their hands and filling baskets with them. The Indians placed spruce boughs in the water, and when these were taken out not a particle of the original green but what was covered with a thick coating of eggs. An Indian in a canoe, with a stick about seven feet long, and for a distance of about two feet studded with nails, points outward, plied the water with this crude implement, each dip in the water bringing up from two to seven fish, and filling his canoe in somewhat less than forty-five minutes.

## THE EXPLORATION OF THE ATMOSPHERE.

As a general thing we only judge of the value of measurements well by comparison. It is for this reason that mountaineers get a perfect idea of the elevation of a balloon in the atmosphere, if some one tells them that it is sailing at twice the height of the Pic du Midi, and that Parisians obtained a good estimate of the altitude to which the captive balloon rose when they knew that its car was suspended at about seven times the height of the towers of Notre Dame. It was with this thought of the estimation of measurements by comparison that we arranged the annexed figures, for a book that we have just published under the title of the "Aerial Ocean." These speak to the eye very clearly, and give a just idea of the height of the principal mountains in the world and of the heights that man has been able to reach at different times in his efforts to explore the atmosphere.

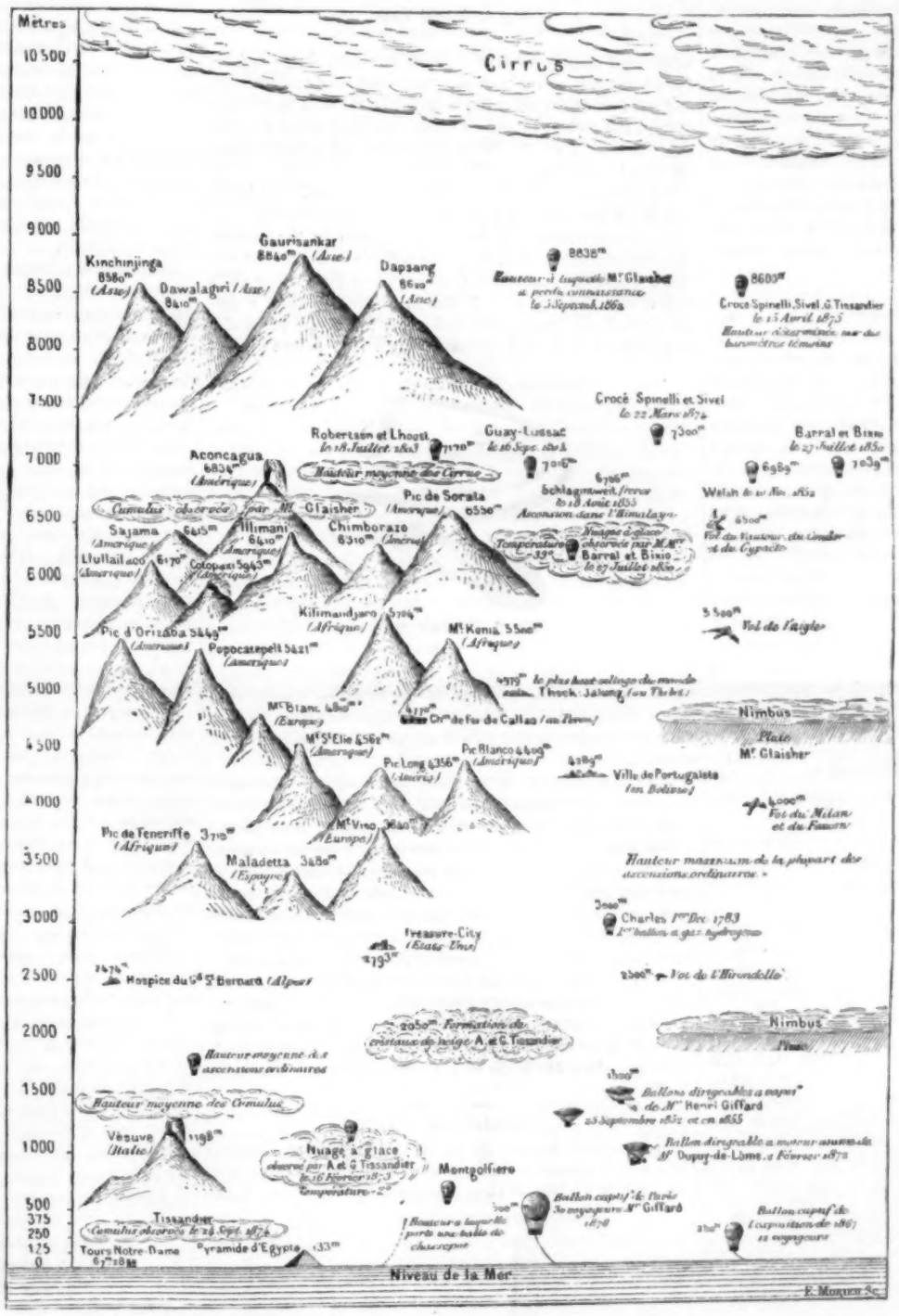
We have just mentioned the towers of Notre Dame, beside which man is so small; but what are they themselves alongside of those giants of nature that we call the Pic du Teneriffe, Mont Blanc, and Gaurisankar, the highest mountain in the world? Above the horizonal line of the sea level we have figured the pyramid of Egypt (133 meters) and the captive balloons of the Paris Exhibitions of 1867 and 1878 (250 and 500 meters). Higher up are the memorable ascensions of Robertson, the Gay Lussacs, the Barrals, and Bixio, who exceeded an altitude of 7,000 meters, leaving beneath them the height to which towers the loftiest peak in America—the volcano Aconcagua.

Above are figured the ascensions of the Zenith (8,600 meters). Above these aerial limits—above Gaurisankar—the atmosphere is not formed solely of rarefied gases; for, up above this peak, up higher than the regions reached by these balloons, there float cirri formed of extremely delicate needles of ice, whose formation plays an immense role in the meteorology of the regions below.

We have figured in our plate a few curiosities of the upper regions. Here, at 2,474 meters, is the hospital of the great Saint Bernard, and, much higher up (at 4,289 meters), the city of Portugalete, in Bolivia; and, finally, still higher yet (at 4,770 meters), the wonderful railway of the Peruvian Andes, in the cars of which the passengers sometimes faint through *puna* or mountain sickness.

If we are astonished at the efforts made by explorers who have, in balloons, reached heights exceeding 7,000 meters, what shall we say of the brothers Schlagintweit, who, on the 18th of August, 1855, reached the altitude of 6,766 meters in the Himalaya Mountains. This is the greatest height to which man has ever ascended on a mountain.

Although these bold climbers were victors in all the combats that they engaged in with the blind forces of nature, one of them succumbed to the cowardly aggression of men, he having been assassinated by Mussulmans.




HIGHEST POINTS REACHED BY AERONAUTS.

Just above the name of the brothers Schlagintweit will be seen those of Croce-Spinelli and Sivel, apropos of their first ascension to a great height on March 22, 1874. They, likewise, in their desire to obey that sublime rallying cry of aeronauts—*Excelsior!*—were obliged to perish as victims to their devotion to science.—*La Nature.*

### The "Dismal Swamp" of Virginia.

From a survey just made, Mr. Richard Lamb, C.E. for the managers of the Dismal Swamp Land Co., estimates this swamp to have 14,000 acres of land that may be reclaimed at a cost of $36,000. The whole basin is about 50 square miles in area, and Lake Drummond, the deepest portion, has a general water surface 22 feet above mean high tide. The geology of the swamp is: First, a stratum of peat or vegetable matter from 10 to 15 feet deep; next, 2 feet of yellow clay; then 4 to 5 feet of blue clay, and, finally, a bottom of quicksand.

The water in the quicksand formation maintains the level of tide water.

### A Colorado Mining Tunnel.

Under the title of the Bellevue Tunnel Company, a number of gentlemen well known in Colorado, among them Lewis C. Rockwell, Lamartine C. Trent, Bradford H. Locke, and Andrew N. Rogers, have associated themselves to undertake a work of considerable magnitude and great promise.

They propose to drive a tunnel from a point on Fall River, a tributary of South Clear Creek, to tap the mines of the western half of all the mines of the great Gilpin County group of gold veins, and at the same time provide for the cheaper transportation of the ores to reduction works through the new outlet.

The past record of these mines and the present output under adverse circumstances speak for themselves. The number of patented lodes intersected by the tunnel, or within half a mile of its line, is given at 181, and it is estimated that their output per day would together reach 1,815 tons. Very interesting figures have been collected by Prof. J. Alden Smith on the saving which would result from the use of a tunnel as compared with the present methods, which carry the cost to $5 per ton. Prof. Smith puts the saving at $1.90 per ton, or nearly 38 per cent. The tunnel would cut the principal lodes of Bellevue, Quartz, Gunnell, and Eureka hills, the total length to reach a point under the latter being 3½ miles. Mr. Locke estimates that the tunnel could be advanced at the rate of a mile a year.—*Eng. and Min. Jour.*



### Winter Mortality among Fishes.

Mr. Charles Hallock, a fisherman of repute, who also wields the pen as effectively as the rod, writes: "People are often puzzled to account for the mortality among fishes, which are frequently found dead in large numbers, in the ocean and inland waters alike, and at different seasons of the year, sometimes in midsummer, and sometimes in the spring after the ice breaks up. There should be no mystery in this. If we turn to the elements of natural history, we read that fishes are cold blooded vertebrates which live exclusively in water, and *respire* by means of gills instead of lungs; and that in process of breathing, the oxygen needed is secured from the air which is mingled with the water.

"If a body of water is hermetically sealed by ice, the oxygen it contains will become exhausted in time, and the fish will die. But ice is porous, and unless it becomes solidified by intense severity of cold, air passes through it into the water below. Also in temperate climates, there are usually throughout the winter occasional periods of thawing, by which process air is absorbed; the ice along shore is also melted, and air holes are found in the body of the ice, to which the fish instinctively resort, as animals would do to crevices or open windows in the closed apartment, and are thereby revitalized. Under such conditions no mortality occurs.

"Sometimes there is an unseasonable rainfall in the winter season which overflows the ice of ponds or lakes; or the feeders of those lakes may be swollen by a flood and overflow the ice; and it is thus not uncommon for fish to find their way to the overflowed surface through the air holes, or the open water along shore, seeking for air. If a hard freeze follows, these fish, becoming benumbed and unable to find their way back, are frozen in and remain embedded until the ice finally melts in the spring and leaves their released carcasses floating on the surface of the water.

"Again, when the winter is ushered in by extremely cold weather, and the water freezes rapidly, fish will congregate at open spaces for air, keeping near the surface, and before they are aware of it, the ice forms around them and incloses them. I have seen large blocks of clear ice cut from the surface of deep ponds for domestic uses, containing many catfish and bullheads, which are bottom fish with hibernating habits; but the winter unexpectedly overtook them before they were ready to assume their torpid state and bury themselves in the mud. Ordinarily, they would have avoided such a catastrophe.

"Some fish are more subject than others to mortality from this cause. Pickerel, for instance, prefer to keep on the shoals near shore among the aquatic plants and weeds. In winters of alternate thawing and freezing, they would be even better off than in the deeper waters, because the ice would occasionally become broken along shore, and the plants themselves supply oxygen; but calamities come when most guarded against, and pickerel may be inclosed by the ice freezing rapidly to the bottom, or even embedded by a severe and rapid freeze at the beginning of winter. The chubs, suckers, and trout escape, because they keep in the deeper water not exhausted of its air, or gather around the mouth of inflowing streams, where small spaces are usually kept open all winter by the current.

"The success which almost invariably attends winter fishing through the ice is due to the fish being attracted to the holes in quest of air. Some species of fish consume far less oxygen than others, and will therefore survive conditions which would be fatal to those. This will partly account for the immunity of chubs and suckers, while the pickerel died."

AT the last meeting of the Paris Academy of Sciences it was stated that a person who for the past two years has been experimenting near Nice with sulpho-carbonates and sulphur, as a remedy against the phylloxera, states that in five hectares of infected vines it is no longer possible to find any phylloxera.

### Health of Cities.

Longevity and premature decay are doubtless influenced by the food and general habits of the people, and by temperature and other local atmospheric conditions, although all these may be largely modified and brought under control by attention to sanitary laws and appliances. Artificial atmospheres are, in fact, created in large cities according to the character of the buildings, the air space allotted in them to each inmate, and the mode of ventilation and warming, as well as by the width of the streets, the sewerage, and other sanitary arrangements. Moreover, the hereditary constitutions of the citizens become in after generations affected by the condition of the cities in which they and their forefathers have lived.

The facts and figures before us point to many of the causes for so great a variation in the death rate as has been shown to exist in different cities. A high death rate will in most cases be found to be the companion of defective house accommodation, ventilation, water supply, sewerage, or scavenging. Thus, for instance, St. Petersburg, with a population of nearly a million, and the high death rate of 35·2 per 1,000, is without sewerage, and its water supply is taken from the river Neva, more or less contaminated by percolation from the subsoil. Cairo, with a death rate of 37 per 1,000, is supplied with water from the Nile, having no sewers, and the sewerage filtering through the subsoil into the Nile above the water intake. Vienna, with a death rate of 29·2 per 1,000, has an average of 60 people in each house, or twice as many as in Paris, while the ratable value of the houses in Vienna is only one sixth more than those in Paris. Pekin, with a death rate of 50 per 1,000, is without proper sewerage, water supply, street cleansing, or other proper sanitary arrangements.

### Snake Bites and Hydrophobia.

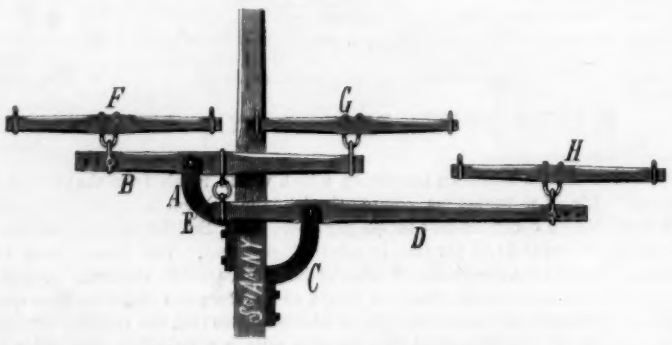
In a recent lecture in New York, Dr. Woodbridge said: "In case of a bite of a venomous serpent, the old historic method of sucking the wound with the lips is one of the first things to be resorted to. If the poison is in the circulation, the use of strong brandy or whisky, in quantities powerful enough to produce intoxication, must be resorted to. The bite of a mad dog should be cauterized at once, by a pencil of lunar caustic or by application of irons heated white. The peculiarity of hydrophobic poison is that it remains in the spot where the bite occurs for several days or weeks, and not until this poison ferments does it become dangerous. Dr. Hewett, a surgeon of London, allowed himself to be bitten no less than eighty times by rabid dogs, each time successfully cauterizing the wound. He fell a victim to his temerity, however, for one day he was found dead with a pistol shot from his own hand. A statement was left in his papers that he had neglected the cauterization too long, and feeling the first symptoms of hydrophobia, he preferred to die without the long agony."

### IMPROVED DRAUGHT EQUALIZER.

The engraving represents a draught equalizer for three horses, so constructed that the draught is direct, and each horse exerts a like draught. The arms, A C, are fastened to opposite sides of the tongue, and the pivots in their ends are at equal distances from the tongue. To the free end of the arm, A, is pivoted a double tree, B, to one end of which a single tree, G, is held permanently, and to the opposite end a single tree, F, is held adjustably by a pin which is passed through a clip on the single tree and through one of a series of holes in the end of the double tree. The double tree is pivoted about two-fifths of its length from the outer end. To the free end of the arm, C, is pivoted a double tree, D, on the outer end of which a single tree, H, is held by a pin passing through a clip and one of a row of holes on the end of the tree, D. The inner end of this double tree is connected by loops, E, with the middle of the double tree, B. The double tree, D, is pivoted about one-third of its length from its inner end. The middle horse may have a leverage of two-thirds over the horse on the other side of the tongue, while the horse attached to the tree, H, will have a compound leverage over the middle horse.

By means of the holes in the ends of the two double trees the leverage can be varied to suit conditions. The direct draught of the tongue is in the center of the two draught points. To turn, the horse at F eases up while the horse at H pulls, and the turning in this direction is accomplished without the aid of the neck yoke. The device is simple in construction, and can be quickly and easily adjusted to varying conditions.

This invention has been patented by Mr. John Bowers, of Brookville, Illinois.




BOWERS' DRAUGHT EQUALIZER.

### Paint for Iron.

The *Neueste Erfinderung* describes an anti-corrosion paint for iron. It states that if 10 per cent of burnt magnesia (or even baryta or strontia) is mixed cold with ordinary linseed-oil paint, and then enough mineral oil to envelop the alkaline earth, the free acid of the paint will be neutralized, while the iron will be protected by the permanent alkaline action of the paint. Iron to be buried in damp earth may be painted with a mixture of 100 parts of resin (colophony), 25 parts of gutta-percha, and 50 parts of paraffin, to which 20 parts of magnesia and some mineral oil have been added.

### IMPROVED TRUSS.

The principal feature of the improved truss, hereby illustrated, is the insertion of a "universal joint" into the back pad. This gives an *even, self-adjusting* pressure upon the back of the wearer, thus enabling him to wear the truss for long periods of time without discomfort.

While applicable to all kinds of trusses, it is especially valuable in connection with a direct acting, one side, single rupture truss, as distinguished from a truss which reaches

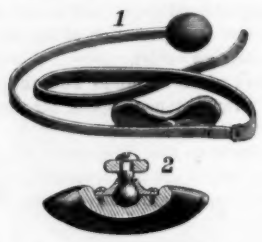



Fig. 1.—BACK PAD.

across and around the body. Such one side, single trusses have heretofore never had any back pad, and the pressure and pain produced upon the muscles of the hips have often obliged the patient to cease wearing his truss when he, perhaps, needed it most. With this device all pressure upon the hips is avoided.

No. 1 shows the back pad attached to the ordinary truss, and No. 2 the universal joint inserted in the back pad.

An improvement in front pads is shown in the accompanying engraving, Fig. 2. This pad gives an inward and upward pressure, similar to that produced by holding one's fingers over the rupture. It also furnishes a gradual resistance to all motions of the abdomen; following the abdomen inward at a mild pressure, when it is drawn in, and

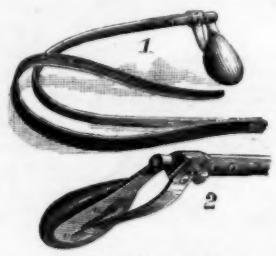



Fig. 2.—FRONT PAD.

giving a very strong resistance when the abdomen, through any variation in the position of the body, is pressed outward. This pad can, therefore, be depended upon to hold a rupture securely under almost any circumstances, and with comfort.

The pad is retained in the same place on the abdomen, and throws any change of bearing from any possible movement of the body upon the variable motions of the spring.

This spring is attached to the end of the hoop over a slanting plate, which gives it a forward direction, and is held in place and guided by a guard on the back of the pad. In the upper end of the pad is a ring fitting loosely on to the end of the hoop, thus allowing the spring to throw the pad easily forward and backward, according to the pressure applied.

No. 1 is a rear view and No. 2 a front view of the device.

These improvements are covered by two patents, and are, therefore, separately applicable to different kinds of trusses. The inventors are Messrs. Darling & Schulz, care of H. A. Schulz, corner De Kalb and Central Avenues, Brooklyn, N. Y.

### Catching the "Ai."

The peculiar manner in which this celebrated Japanese fish, which belongs to the Salmonidæ (the Salmo altivelis of authors), is caught is thus described by Mr. Pierre Louis Jouy: After whipping the stream with flies, as for trout, and securing a fish, a fine gut line is passed through the nostrils and fastened to a line held in the hand; trailing behind the fish thus fastened, which is simply a decoy, are several bright hooks which flash in the sunlight and attract other fish. The decoy is now gently led up stream, and the fish, in darting after it, get snagged on the hooks. Horse hoof parings, used as lures, are said to be successful with "ai"; they are also caught with weirs.

### Objections to Light Draught for Vessels.

Having stated a few of the apparent advantages of light draught, it is but reasonable to give consideration to the objections as well which may be urged against such a mode of construction.

One is, that such a craft will not hold her wind; she takes such slight hold of the water that when close hauled she will slide off to leeward and lose more than she makes, and in fact with a wind any way but dead aft she will go nobody knows where. For a sailing vessel this would be a fatal difficulty, and even for a steamer one not to be disregarded. But it is surely one easily surmounted. A movable keel is entirely within power of management. Our vessel of 160 feet, drawing five feet loaded with 2,500 tons, can readily add five feet to that draught when in free water. That keel may be, for ease of action, in three or more divisions, each corresponding to our present center board.

The small height of free board, and the consequent liability to be swept by the seas in rough weather were incidentally mentioned in our former article. We have no idea that in working against such a sea as we must expect to encounter at times, especially if we are driving a steamer with speed, dead to windward, we can carry dry decks. We cannot do it with our present models, high out of the water as they are built. But what we contend is this: that the greatly increased buoyancy which we have secured will more than compensate us for the diminution of height. That which causes a sea to break on board is the resistance which it encounters. An air filled globe, like a balloon, could never ship a sea; it would rise instantly over it. That, in its degree, is our full belief concerning the model we have ventured to propose.

Rushing down from a sea, and striking the next one ahead of her, she will from her breadth and lightness begin to rise with the instant, instead of cutting in and down, deeper and deeper, as is now the case. Her bow is buried, as we plan that it should be, but as it buoys itself quickly it shakes off the load and goes over the wave which it has struck, while the real deck, commencing fifty feet aft, even with its slight elevation, sees less salt water than at present.

But the greatest objection which can be urged against the form which is to give us such light draught is the extent of surface which we present to the water for friction, and its consequent resistance. It cannot be denied that the proportion of "skin area" to amount of tonnage capacity is largely increased. It is safe to say that the increase is at least sixty per cent as compared with vessels of a present average model. And if by means of this we have lost speed in the same degree, our plan can expect to find but little favor. We must "make time" at whatever cost. But it is by no means certain that we are going to lose any time. Two important points demand our consideration.

The degree of friction encountered by one of our present deep draught ships is to be measured in part by the amount of her "skin area," but only in part. For a chief factor is the amount of pressure under which that surface acts. The water which she displaces in her progress offers resistance according to the depth at which she acts upon it. That which she is crowding away, fifteen to twenty-five feet down, cannot yield as that does at her water line. Here is where we have in our new form a very great advantage; we are floating, so to speak, on the very surface of the water. We go over the seas, and not through them. The problem involves so many complex factors and relations that no exact results can be worked out except by actual trial. But it is certainly reasonable to consider it.

The second point is this: It is now very well settled as a law of hydrodynamics that a large part of the resistance to a ship's progress is due to the production of waves, from the difference in pressure at the bow and stern as compared with the sides. At a high rate of speed this is reckoned at 30 to 40 per cent of the total amount. Now, as this element resistance becomes necessarily much less in our "skimming dish," we have made a gain which may fairly pass to our credit as against the increase of friction. And it is our own belief that not only equal, but actually superior, speed can be obtained by the surface floating craft. This, however, can be determined only by trials faithfully and patiently made. We hope to see this done. A.

### Bridge Receipts for Two Months.

The gross receipts of the Brooklyn Bridge were $76,420 for December and January. Upon the last Wednesday of January, a day of dense fog, the receipts were as follows:

Cars, $1,476; roadways, $286; promenade, $147; total, $1,909. On Thursday they were: Total, $1,697; cars, $1,367; roadways, $218; promenade, $112. On Friday they were: Total, $1,624; cars, $1,294; roadways, $228; promenade, $102. The receipts for the same three days of the previous week were as follows: Wednesday, $1,432; Thursday, $1,207; Friday, $1,385—making a total for the three days of $4,024. The total receipts for the three busy days of last week were $5,230, an increase of $1,206 over the same days of the previous week.

The receipts for December and January were as follows: December—cars, $30,022; roadways, $4,545; promenade, $2,506; total, $37,073. January—cars, $33,192; roadways, $4,246; promenade, $1,909. The increase for cars in January over December was $3,170; decrease for roadways, $299; for promenade, $597; total increase for January, $2,274.

### Greek Fire.

At what period the ancient Greek fire was invented has never been certainly determined. There are many writers who place the invention in a far antiquity. Historical details have been adduced pointing to the period of the earlier wars between the Greeks and Romans as the true era of the discovery. But we do not find any certain evidence of the use of Greek fire until the sieges of Constantinople, in the seventh and eighth centuries, though a Father of the Christian Church, writing in the fifth century, gave receipts for making a combustible substance of similar qualities from the compounds resin, sulphur, pitch, pigeons' dung, turpentine, and the juice of the herb "allheal."

It is related that the true Greek fire was invented by a certain Callinicus, an architect of Heliopolis, in Syria (Baalbec) in 678. The secret of the composition of this artificial flame, and the art of directing its action, were imparted by Callinicus—who had deserted from the Caliph—to the Emperor of Constantinople. From this period until the year 1291 the use of Greek fire was an important element in the military power of the Byzantine empire. The progress of the Saracens was, more than once, decisively checked by the destructive action of this powerful and terrible flame. The important art of compounding the fire "was preserved at Constantinople," says Gibbon, "as the palladium of the State; the galleys and artillery might occasionally be lent to the allies of Rome; but the composition of the Greek fire was concealed with the most zealous scruple, and the terror of the enemy was increased and prolonged by their ignorance and surprise."

The accounts which have reached us respecting the properties of the Greek fire are such as to justify the high value attached by the Byzantine emperors to the secret of its composition. It was a liquid, which was propelled by various methods against the ships or engines of the enemy. So long as it was kept from the air, or remained in large masses, the liquid appears to have been perfectly safe from combustion; but as soon as it was poured forth it burned with an intense flame which consumed everything around—not merely burning upward, but with equal fury downward and laterally. Water not only failed to quench it, but made it burn with new ardor. To subdue the flames it was necessary to employ, in large quantities, either sand or vinegar. Various methods were employed for propelling the liquid fire toward the enemy. Sometimes it was inclosed in vessels made of some brittle substance, and these were flung at the enemy by means of suitable projectile machines. "It was either," says Gibbon, "poured from the rampart in large boilers, or launched in red hot balls of stone and iron, or darted in arrows and javelins, twisted round with flax and tow, which had deeply imbibed the inflammable oil." But the effectual use of the destructive compound seems to have been best secured by means of a species of fire ships specially constructed for the purpose. Copper and iron machines were placed in the fore part of these ships. Long tubes, fantastically shaped, so as to resemble the mouth and jaws of savage animals, formed the outlet for a stream of liquid fire, which the engine—literally a fire engine—propelled to a great distance. Hand engines were also constructed by which the destructive compound could be spurted by the soldiers, Beckman tells us.

The secret, as we have said, was carefully kept by the Byzantines. The Emperor Constantine suggested the answers which in his opinion were best fitted to elude the pertinacious questioning of the barbarians. "They should be told that the mystery of the Greek fire had been revealed by an angel to the first and greatest of the Constantines, with the sacred injunction that this gift of Heaven—this peculiar blessing of the Romans—should never be communicated to any foreign nation; that the prince and subject were alike bound to religious silence under the temporal and spiritual penalties of treason and sacrilege; and that the infamous attempt would provoke the sudden and supernatural vengeance of the God of the Christians." Gibbon adds that the secret thus religiously guarded was "confined for above 400 years to the Romans of the East; and at the end of the eleventh century the Pisans, to whom every sea and every art were familiar, suffered the effects without understanding the composition of Greek fire."

This, however, is not wholly true. The secret was preserved, indeed, from the Romans of the West, but the Saracens managed to possess themselves of it very much earlier than Gibbon's account would imply. For, at the siege of Thessalonica, in the year 904, the Saracens, we are told by John Comeniata—threw liquid fire, by means of tubes, upon the wooden defenses of the besieged, and by this means principally succeeded in capturing the town.

In the Holy Wars the Mohammedans freely availed themselves of the use of Greek fire. Gallant knights, who feared little the swords or lances of the Saracen host, were terrified by the uncouth aspect and the hideous noises of machines which belched forth upon them a torrent of liquid fire. Joinville tells us that "it came flying through the air like a winged long tailed dragon, about the thickness of a hogshead, with the report of thunder and the velocity of lightning; and the darkness of the night was dispelled by this deadly illumination."

It does not by any means follow, because the invention of gunpowder rendered the ancient Greek fire no longer a very useful military weapon, that the knowledge of the secret of its composition would be of little value. We must remember that the use of firearms rendered the old fashioned engines, by means of which the liquid was propelled, no longer available, since those who worked the engines could no longer venture near enough to the enemy. It was to this cause, we suspect, rather than to any want of efficiency in the compound itself, that the discontinuance of the use of Greek fire should be ascribed. The time had not yet come for making gunpowder itself a useful adjunct to the employment of liquid flame.

It is not so clear, however, that the ancient Greek fire was much more efficient than that which has recently come into use. Still, the inquiry into the nature of its composition is not without interest.

The Princess Anna Comnena states that Greek fire was compounded of sulphur, resin, and oil. It may be well to dwell on this point, since many writers have been disposed to consider naphtha, or liquid bitumen, to have been the principal ingredient of the Greek fire. Possibly, however, the oil mentioned by Anna Comnena may have been naphtha, and not, as one would be disposed to infer, any of the ordinary vegetable or mineral oils; for the use of naphtha in lamps is of great antiquity.

Gibbon writes: "Naphtha was mingled, I know not in what proportions, with sulphur and with the pitch that is extracted from evergreen firs—that is, resin—in forming Greek fire."

It is a moot point whether Friar Bacon ever discovered the true composition of the liquid fire. Many supposed that he concealed a real ignorance on the subject, when he supplied an apparently unmeaning answer to the questions addressed to him. Others, however, assert that two of the components of Greek fire were, as Bacon said, sulphur and saltpeter, and that the third is to be detected in the logogriph—"Luru vopo vir Can utriet." We leave this anagram to the ingenuity of our readers, mentioning, in passing, that it contains the apropos words, "urit voraciter," but that the extraction of these words leaves us only the combination "lupovun," from which it will not be found easy to form a word. Possibly there is a mistake in transcription to add to the anagrammatic difficulty.

Many others have tried to elucidate the question. Friar Bungay, Charles du Frene, Ducange, and Joinville—a host, in fact, of commentators, historians, and antiquarians—have all had something to say more or less to the purpose. But the satisfactory solution of the problem has not yet been obtained, nor perhaps is it likely to be.

It has been well remarked by a writer on the subject, that "gunpowder blew the ancient Greek fire out of the field." But during the American war of 1860–65, it was shown that gunpowder might be used to blow modern Greek fire into cities. Whether the example will ever become a recognized military precedent is uncertain. But it has been shown that Greek fire may be flung into a city by means of a suitably prepared shell, and that its destructive properties may thus be made available when the besieging force is four miles or more from the central parts of the city. Charleston was certainly not destroyed by General Gillmore's fire shells; in fact, there are difficulties connected with the construction of such shells, which, though far from being insuperable, were not wholly mastered by the artillerists under Gillmore. But that an immense amount of damage was effected is shown by the fact that General Beauregard hurled from the mouth of his cannon denunciations against Gillmore for employing "the most villainous compound ever used in war."

That Greek fire will one day be employed as a fearfully destructive agent in warfare seems scarcely probable. Yet, so far from looking forward with dismay to the prospect of such an application for its properties, we may rather, perhaps, consider that prospect as favorable to the interests of peace. We may apply to this case the remarks applied by Fuller to the use of cannon—"Though some may say that the finding of such appliances hath been the losing of many men's lives, yet it will appear that wars are now fought with more expedition, and that Victory standeth not so long a neuter, before she express herself on one side or the other."—*Knowledge.*

### Minnesota Sorghum Amber Cane.

The Minnesota sorghum cane growers have just held their fourth annual meeting at the State University in Minneapolis. The perseverance of the association is remarkable, considering the disastrous results of the past two years. It seems to be agreed that, for a successful crop either of corn or of cane, there must be an average temperature of 70° for 90 successive days. The average for the summer of 1883, in the latitude of Minnesota, was but 67°.

But a new and experimental industry ought not to be discouraged because of such a calamity of climate, by which all crops not harvested before the exceptionally early September frost suffered as well as the cane crop. The problem demanding first attention is that of securing a mature crop; in regard to which the perfection of seed, thoroughness of culture, and elimination of suckers from the mature stems may be considered the most important factors. Hybrids should be sought that are earlier and more hardy even than the celebrated "early amber cane."

Among interesting facts brought out was that, as a sirup making plant, the amber cane may now be considered as nearly perfect. As a sugar making plant, however, it is to be noticed that it yields two sorts of sugars. The crystallizable variety is what we desire, as there is hardly any demand in market for the uncrystallizable. Experiments excite the hope that amber cane may yet be made to yield 10 per cent of the best sugar and but 2 per cent of the inferior sort. It well known that when the sugar beet was first experimented with, about a century ago, six per cent of sugar was the most that it was thought possible to get, whereas under modern methods the yield is from 12 to 15 per cent. This development has been made in the face of difficulties far more formidable than those confronting the champions of amber cane. It should not be forgotten that the seed alone will always pay the cost of the crop, as it yields at the rate of 150 pounds to the ton, and is worth as much as corn. It resembles buckwheat in taste, appearance, and properties.

Prof. Wiley, Chemist of the Agricultural Department at Washington, was present, and gave an address, on the second day, on "The Northern Cane Industry." He began with the statement that foreign sugar is being now imported at the rate of 1,250,000 tons annually, and that, if the home production does not soon increase, the importation will rise to 2,000,000 tons. At present there are four large sorghum sugar factories in the United States, that produced last year an aggregate of 1,000,000 pounds. The speaker averred that the best sirups and molasses in the world are now made out of sorghum canes, the value of which is steadily rising, so that the whole crop of last year sold at an average of fifty cents per gallon. The lingering prejudice against sorghum sirup is due to imperfect defecation; an evil that may be remedied by filtration, heat, and chemical agents. These were minutely described, and the gratifying conclusion reached that amber cane sirup, when properly treated, cannot be made to ferment under any ordinary conditions of temperature and exposure.

It may be added that, while sorghum was introduced into America from China about thirty years ago, it is only about fifteen years since that Mr. E. Y. Teas, while experimenting on some cane seed purchased in Paris, noticed a single head of the canes raised from it, that differed from the rest. The next spring he planted this seed by itself and found that the result was a very early cane, and the sirup made from it was of a fine amber color. In consideration of these qualities it was called "The Early Amber." This new variety was introduced into Minnesota in 1874, by Mr. C. F. Miller, who, together with Mr. S. H. Kinney, has brought the northern culture of cane to its present hopeful condition.

The officers chosen by the association for 1884 are: President, Capt. R Blakely, of St. Paul; Vice President, Mr. Wyman Elliot, of Minneapolis; Secretary and Treasurer, Prof. E. H. Porter, of the State University.

H. C. H.

### Aboriginal Dwellings in Arizona.

An interesting discovery has been made by Mr. James Stevenson, of the United States Geological Survey in Arizona, where explorations have been carried on for some time. It will be remembered that some extensive villages of caves and houses built in the sides of cliffs were found in the same district a year or two ago, and more recent investigations have shown the existence of several others, differing in certain ways from those first observed.

The most curious of the newly discovered towns formed a group of pits, about sixty-five in number, sunk in the volcanic foot hills of the San Juan Mountains. Each dwelling consisted of a central cavity, oval in shape, and about twenty feet in its shortest diameter, with arched roof, and surrounded by three of four smaller apartments communicating with the central hall by passages, but entirely isolated from the adjoining habitations. Access to each of these groups of rooms was obtained through a square shaft, which had holes cut in its walls to serve as steps, and a groove in one side which answered for a chimney flue. The shaft entered at one side of the main hall, and the upper end was surrounded by a fence of loose stones, to guard against the entrance of unwelcome guests.

About fifteen miles from this singular town was found another, consisting of a large number of huts, built of stone, in a sort of horizontal crevice in the perpendicular wall of a deep canon. The houses stood in a single row, with the back against the rocky wall, the fronts and sides only being constructed of large stones laid in clay. A narrow path extended along the front of the houses, and the deserted groups formed almost a continuous line of houses for about five miles along the side of the canon. Many simple utensils of wood and stone were found in the huts, but no inscriptions or other indications of high civilization.

### Iron in New South Wales.

In our advertising columns will be found a remarkable invitation addressed to the iron masters of Europe and America by the Government of New South Wales. This prosperous colony is very rich in iron and coal of excellent quality. The Government has within a few years constructed over 1,200 miles of railroad, and more than 500 miles are in course of construction, all the materials for which, except the sleepers, have been imported at a heavy charge in the way of freight, etc., from England. These charges should operate as a large "protection," and afford great inducements to enterprising men to embark in the manufacture of iron and steel in the colony. It is stated that 1,250,000 tons of iron and steel, inclusive of permanent way material, have been imported into New South Wales and Victoria within the last ten years. The Government has determined to make a bold experiment to naturalize the iron industry in the colony, and has, in the terms of the notice which we publish to-day, called for tenders for 150,000 tons of steel rails (or any portion thereof) to be manufactured in the colony from New South Wales ores.

## ENGINEERING INVENTIONS.

A method of operating trains on cable railroads has been patented by Mr. Paul H. Mayor, of Owego, N. Y. This invention covers a special combination of the cable and locomotive systems of propulsion, and is mainly designed to be applied to steep grades, but is also applicable to varying grades, where an incline is interrupted by levels, contrary grades, etc.

An alarm signal for hot journals has been patented by Messrs. Oliver H. P. Cornelius and George H. Turner, of Turner, Ore. A thermometer is suitably placed in contact with a journal bearing, with which is connected a wire from a battery, so that when the mercury reaches a certain point a circuit will be closed and an alarm signal sounded.

An improved pitman box has been patented by Mr. Fenner Darling, of Franklin, Mass. The invention consists principally of an inner sleeve placed upon the wrist pin, the sleeve being adapted to be revolved intermittently by the movement of the pitman, so the wrist pins of the pitman boxes are relieved of part of the wear and retain their cylindrical form.

An improved car door fastening has been patented by Mr. Jacob Rhule, of Pittsburg, Pa. A hasp with a hook end and a slot at the opposite end is held on the door by passing its hook end through an eye bolt in the door frame and passing a staple in the door through the slot in the opposite end of the hasp, whereupon a bolt or the hasp of a padlock is passed through the staple on the door.

An improved car coupling has been patented by Mr. Frank L. McQuiston, of Greencastle, Iowa. The invention provides for a drawhead having attached a crossbar provided with bearings, in which slides a rod with stop pins and a spring, and carrying a coupling pin bent to pass horizontally through the drawhead, the device being applicable to a car with ordinary couplings by using a link made with a half twist.

A coking furnace has been patented by Mr. Arthur R. B. Hlawski, of Zaborze, Upper Silesia, Germany. Between a series of coking chambers are gas chambers, into which gas is passed from the coking chambers, the gas chambers having openings in their bottoms leading to transverse channels, connecting with longitudinal channels below the gas chambers, so the gases will circulate until exhausted, and thus all be consumed as the coal is converted into coke.

A roasting furnace has been patented by Messrs. Newman A. Foss and John M. Gray, of Clendenin, Montana. The object is to improve roasting and slagging furnaces, for which purpose a long tube of boiler iron, lined with fire brick, is arranged between the receiving chamber and the chimney, and smaller in diameter from the furnace to the chimney, with inside ledges, down which the ore falls in passing from one section to the other, having a more complete exposure to the heat.

## MECHANICAL INVENTIONS.

A circular sawing machine has been patented by Mr. George J. Kautz, of Emporium, Pa. This is an improved construction and arrangement of parts for that class of circular sawing machines in which the saw frame is automatically swung into position by a cam, and the feed roller is also automatically operated.

A skein lacing and tying attachment for reels has been patented by Mr. George Grimshaw, Jr., of Paterson, N. J. By this improvement time is economized, the skeins are less liable to become tangled in dyeing, the thread can be more readily wound, and will be freer from knots than when the skein has been laced in the ordinary manner after having been reeled.

A boring gauge has been patented by Mr. Thomas J. Bush, of Lexington, Ky. This invention relates to three former patents of the same patentee, and consists in adapting the gauge to be held and the means for holding it upon a railroad tie parallel with the rail, so the intersecting diagonal holes for receiving the bent bolts may be bored in the tie at the side of the rail instead of crossing under it.

A ratchet wrench has been patented by Mr. Charles Wechsler, of Minneapolis, Minn. The wrench head is provided with a system of concentrically arranged angular sleeves or slides, of decreasing size to the center, but which extend through the head to form a right hand wrench on one side and a left hand one on the other, these sleeves or slides having rectilinear slots, guided on pins, so they may telescope freely, and this head is combined with a ratchet handle.

A machine for washing, scouring, and burring wool has been patented by Mr. James E. Sinclair, of Baltimore, Md. This machine covers all three of these operations in preparing wool for carding, the fibers being first thoroughly separated and agitated in cold water, and from thence pumped into a scouring apparatus, where only a brief treatment with hot water is necessary, whence the wool is pumped into a burring and picking apparatus, where it is rinsed in cold water and burred and picked, and then discharged from the machine in condition to be dried and then carded.

## AGRICULTURAL INVENTIONS.

A horse hay rake has been patented by Mr. James M. Clark, of Greeley, Colo. This rake is adapted to be dumped by the rotation of the axle, and an improved means is provided for holding and operating the devices for controlling the action of the rake.

A hay stacker has been patented by Mr. James H. Johnson, of Greencastle, Mo. The object of this invention is to facilitate the operation of stacking hay, which is effected by a movable apparatus, whereby, when a horse is attached to the hoisting rope, a loaded fork is raised into an upright position, and the hay discharged upon the stack.

An improved plow has been patented by Mr. J. T. Ellyson, of Pleasant Plain, Iowa. In combination with the mould board and a flanged bar secured thereto is a slotted forked plate carrying a roller, disk, and scraper at its forked end, and there is a bolt on the flanged bar for adjustably fixing the slotted upper end of the plate.

An automatic register for grains, seeds, and other substances has been patented by Mr. John Wherry, Jr., of Putnam, Ill. There is a grain register in a two-compartment case, with an adjustable guide plate connected by levers and rods, with hinged bottoms having elastic bars engaging with weighted scale beams, so arranged as to measure grain, seeds, etc., as they come from the thrashing machine or bin.

A pea thrasher and cotton opener has been patented by Mr. Calvin H. Simmons, of Munford, Ala. There is a perforated sheet metal or woven wire concave, with spikes or teeth, and a revolving shaft with other teeth, preferably bent or curved reversely, to hold straw, lint, etc., away from the bottom and walls of the case, keeping the perforations open, through which the peas, grain, etc., escape.

A thrashing machine has been patented by Mr. Andrew T. Hawley, of Alton, Ill. It is intended to prevent waste of grain and thoroughly separate the latter from the straw. There is a heavy beater adjoining the thrashing cylinder and revolving in an opposite direction, with a light beater above and in rear of the heavy one, but revolving opposite thereto, so the straw will be received from the cylinder by the heavy beater and thrown upward, and as it falls be subjected to the light beater.

## MISCELLANEOUS INVENTIONS.

An improved button has been patented by Mr. William W. Beach, of New York city. This invention consists of a button with a transverse aperture in the shank, into which may be received or through which may be passed the point of a pin.

A horse detacher has been patented by Mr. William M. Walker, of Fulton, Ky. This is an improved device for detaching the trace and shaft of the carriage, with a foot lever arrangement for working the same and a brake.

A coin holder has been patented by Mr. Charles C. Johnston, of Jackson, Miss. It consists of two semi-cylindrical sections or casings hinged to each other at the adjoining ends, into which sections the coins are placed, and is simple in construction and cheap.

A hive cart or hand cart, specially adapted for shifting bees from place to place, has been patented by Mr. Charles R. Thompson, of Fort Omaha, Neb. The handles of the cart serve as levers for lifting the bee hive on low hung carriers, so a heavy hive may be lifted and moved without calling for much outlay of strength.

A ripping attachment for scissors has been patented by Mr. Francis S. Lockerman, of Manokin, Md. A casing is secured to the under side of one of the handles, and there is a ripping blade pivoted to and adapted to fold within said casing, in connection with which a spring may be used or not as desired.

A binding attachment for sewing machines has been patented by Mr. Robert Hilgner, of New Orleans, La. This invention covers a special construction and combination of parts to make a sewing machine binder as an attachment for guiding a binding to be sewed upon the edge of a garment.

A fire escape has been patented by Mr. Robert P. Clark, of Philadelphia, Pa. A cage is suspended by operating ropes from a horizontal traveler, said ropes passing over guide pulleys and being attached to drums revolved in opposite directions by connecting gear wheels, and operated by a crank, so the cage may be moved either vertically or horizontally.

A clay pulverizer has been patented by Mr. Lorenzo D. Ferguson, of Nashville, Tenn. The pulverizing machine combines plain rollers and toothed cylinders running at different speeds, so that the clay will not form in cakes or sheets as passed through, but will be thoroughly pulverized, for making bricks or fine ware.

A huller, cleaner, and separator has been patented by Mr. William W. Jackson, of Bethany, La. This invention combines a fan, inclined sieve, rotary toothed hulling cylinder and stationary toothed case, so devised and constructed as to make a simple and effective machine for stripping or clearing the hulls or pods from peas, beans, etc., and separating the same.

A supporting rod for window and door curtains has been patented by Mr. John A. Browne, of Philadelphia, Pa. A socket is fixed to one side and a screw plug to the other side of the casing, in line with each other; then one end of the rod is inserted in the socket and on the other end is fixed a socket nut, which is screwed upon the screw plug.

An adjustable finger ring has been patented by Mr. Benjamin Lewkowitz, of New York city. In combination with a stone frame with inclined pockets on the sides is a removable shank, its ends passing into the pockets, the shank being held in place by screws passing through the edges of the pockets and adapted to bind on the edges of the shank.

An improved grain drier has been patented by Mr. William H. Applegate, of Atlantic, Iowa. There are special constructions of grain passages, discharge valves, and heating apparatus, with provision for the escape of moisture, and for the air heated from below to ascend about the grain passages, also for the escape of any dust, and for maintaining a free air inlet.

A fire escape bracket has been patented by Mr. Charles Murdock, of New Rochelle, N. Y. This is an improvement for use in connection with the fire escape patented by the same patentee last year, and covers a special construction of bracket to be attached to the window casing or wall of a building, to admit of its being folded down to or swung away therefrom.

An improved elevator has been patented by Mr. Riley L. Davis, of Mooresville, N. C. This is a novel arrangement and combination of parts for elevators with adjustable scaffolds on the lazy tongs principle, additional pairs of lazy tongs being used, their knees connected in a flexible manner, and the platform having slotted pendent guides.

A lasting machine has been patented by Mr. Augustus W. Pearson, of Nyack, N. Y. In a suitable frame fronting the operator, jaws are made to seize the upper, as held up in proper connection with the last, pull the upper over and hold it on the last, while an automatic tack feeding arrangement and hammer fix the upper under the desired strain to the last, in close imitation of hand lasting.

A fire escape has been patented by Mr. Thomas B. Peacock, of Topeka, Kansas. It is an inexpensive apparatus, consisting of a car suspended by a rope, combined with a ring and pulley adapted to bear against a suspension rope; and with a lever and pulley also adapted to bear against the rope, so that a number of persons can safely and rapidly escape from a burning building.

A scaffolding bracket has been patented by Mr. Mark N. Knight, of Skowhegan, Me. It is formed of two pieces of timber with notched edges, one having at its upper end a pivoted link through which the outer piece of timber can be passed, or which link passes through a slot in the other piece of timber, making a bracket simple and strong for staging and scaffolding in rooms and on buildings.

A pneumatic coal cleaner has been patented by Mr. Amour Sottiaux, of Strepy-Bracquegnies, Belgium. In connection with a case having an open side and receptacles across its bottom, with means for introducing material at its upper part, is a contrivance admitting air at varying pressures, by which, as coal drops, it may be separated from dust, and from stones, schists, or slates.

A fertilizer distributer has been patented by Mr. Augustine Reger, of Somerville, N. J. The invention consists of a pail with a perforated bottom, on which is a cover with apertures in its lower edge, through which the fertilizer escapes to and drops through the perforated part of the bottom; a cone is also provided for, to be fixed to the under side of the bottom, with its apex at the bottom.

An improved glove has been patented by Mr. S. Oscar Parker, of Littleton, N. H. This invention provides for a peculiar cutting of parts and arrangement thereof, so there will be a double thickness of leather on the wrist over the pulse, and there is a button piece for the opening at the wrist which strengthens the glove and gives it a better appearance, with other advantages.

An improved book case has been patented by Mr. William A. Smith, of Wilmington, Del. This invention provides special devices for locking books in book cases, and may be fitted with equal facility to an open front case or to book cases having their fronts closed with either sliding or folding doors. The locking frame is of vertical bars or mouldings connected by horizontal cross bars or mouldings.

A steam cooker has been patented by Mr. Hudson Maxim, of Pittsfield, Mass. The steam from a generator is carried in a spiral or back and forward under the generator, to be highly superheated, whence its open end is passed into the bottom of the cooking vessel, the heat being thoroughly utilized therein, and the arrangement being adapted for cooking vegetables, meats, etc., very rapidly.

A telephone call bell switch has been patented by Mr. Louis Townsend, of Evansville, Ind. A peculiar torsional spring tube is combined with the telephone support; and this spring tube is embedded in the walls of which the box is composed; there is, also, a peculiar construction of the contact points, the telephone support always having a solid electrical connection with the circuit wire.

A fastener for fence wires and boards has been patented by Mr. Charles E. Griffith, of Storm Lake, Iowa. This invention is principally for providing an improved means of attaching wire or board fences to trees, and covers a device of slotted plate combined with screw bolt, head, and bit, for holding the members of the fence at a distance from the post or trees.

A clock pendulum has been patented by Mr. Levi Orser, of Mobile, Ala. This invention covers a rolling or rocking suspension device, made in such manner as to give two curved lines or points of contact, upon or between which the pendulum is held by its own gravity when the clock is in its proper position, and there is a guard to prevent the parts from misplacement when the clock is turned out of its normal position.

A spring bed bottom has been patented by Mr. Butler R. Platt, of Plainwell, Mich. The invention covers a special construction and combination of parts, in that the connecting portion of each pair of springs has two bends which serve as points of attachment for the hooks of the coupling, preventing them from slipping, and so the springs cannot be forced out of vertical position, also giving a large surface area for the support of the bedding.

A circuit closer for telegraph keys has been patented by Mr. Samuel J. Spurgeon, of Houstonia, Mo. This invention is an improvement on a circuit closer patented by the same inventor last year, and covers a circuit closing spring or lever pressed against the bottom of the key, the circuit closing lever being pressed downward to break the circuit when the key button is depressed by a button and stem held loosely on the button of the key.

A draught equalizer has been patented by Mr. David F. Robbins, of Berlin, Minn. The object is to provide means for attaching four horses abreast to a harvester, so that each horse will draw its proper proportion, and to this end a cross bar is attached to the tongue with pulleys at its ends, around which passes a chain, one end connected with a whiffletree, and the other with an ordinary 3-horse evener, the connections being made as for properly proportioned levers.

A sash cord fastener has been patented by Mr. William A. Sinsel, of Waukesha, Wis. It provides means for a cord being firmly held without being tied, independently of the means for securing the holding device to the sash, and the device has a body, a cap therefor, and a screw, forming a cord clamp and means for holding the same to a sash. The same inventor has also obtained a patent for a window sash, in which, according to one of the specified modes of construction, the sash may be removed from the window casing without removing the window stop.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*

## NEW BOOKS AND PUBLICATIONS.

BLEACHING, DYEING, AND CALICO PRINTING. Edited by John Gardner, F.I.C., F.C.S. P. Blakiston, Son & Co., Philadelphia. Price, $1.75.

This book presents mainly a condensed summary of what has heretofore been presented in more elaborate works. It will make, however, a convenient manual for practical workers who do not wish to give the time and trouble required for more extended research, and contains a good selection of approved recipes, indicating the familiarity of the editor with the more recent English and French methods.

THE MODERN HOUSE CARPENTER'S COMPANION AND BUILDER'S GUIDE. By W. A. Sylvester. Cupples, Upham & Co., Boston. Price, $2.00.

This is a standard book of its kind, and has reached its third edition. It is written for workmen, by one who commenced his preparation for the task in the memoranda made during early experience at the trade. Explanations of the mathematical questions arising in ordinary carpentry and building are fully given, with great plainness of statement and ample illustration. The book is one which any apprentice may study diligently with profit, and which most master builders might find it of advantage to frequently consult.

HINTS ON THE DRAINAGE AND SEWERAGE OF DWELLINGS. By William Paul Gerhard, C.E. William T. Comstock, New York. Price, $2.50.

Every topic of importance touching dwelling house sanitation here receives some attention. Illustrations are given of many different kinds of closets, traps, sinks, piping, etc., with practical directions for securing good plumbing and detecting that which is bad. The book is a valuable contribution to the literature of the people, on the subjects of which it treats, is plain and direct in its statements, and every householder can learn something therefrom relative to improving the sanitary conditions by which he is surrounded.

GEOLOGICAL SURVEY OF ALABAMA, 1881–82, WITH AGRICULTURAL FEATURES. By Eugene A. Smith, Ph.D., State Geologist.

*This is* an eminently practical book, containing a great deal of what might be styled basic information for all present or would-be agriculturists in the State of Alabama. So far as the geology of the State is concerned, there are, perhaps, no points of especial scientific interest to be developed. There is only a small portion of the State, in its northeastern section, where the elevation above the sea equals 500 feet, and the geologist's work is principally confined to an analysis of soils which have come into their present place in a perfectly natural and easily understood way. But the different lands of the State are well mapped out, their formation and chemical composition graphically represented, the different varieties of natural and artificial manures required in various localities fully discussed, and analytical details of present productions given in the most attractive style. The State presents great inducements for agriculturists, particularly in cotton growing, having an area greater than that of the State of New York, without one-quarter of the population.

# Notes & Queries

## HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) G. H. B., Cleveland, O., asks how skins are dressed to render them soft enough to make clothes of, and what is the Indian process? A. Most of the buffalo robes and other heavy skins are either lightly tanned in bark liquors, or tawed with alum and salt, and well worked and dressed with oil. Most skins can be easily prepared for single skins by rolling up with salt and alum sprinkled on the flesh side, first having been well scraped; this wants to be repeated several times, and the skins finally well worked. The Indians rub the brains and fat of animals thoroughly into the flesh and smoke well; the squaws, who always do this work, being obliged to work the skins with great thoroughness.

(2) A. C. R. asks: What is the best, cheapest, and most simple way to dry clays, where it is desirable to have all moisture evaporated, and from to ten twenty tons per day being required, the clay being about the consistency of stiff putty when taken from pit? A. The fire brick makers dry the clay that is to be baked for making fire sand, by placing the lumps as dug out of the pit upon a hot floor of fire tile, which is the cover of a series of flues to a furnace. A coil of steam pipes might be used, but it is expensive. Another way, which is very economical as to heat, is to build a brick room as large as may be convenient for your requirements with shelves all round upon which the clay can be piled. In the center of the room place a heater or large stove; have the pipe turn down upon the floor and around the sides of the room before entering the chimney, so as to save all the heat. In such a room the temperature may be raised to 250°, which will dry very fast. Ventilate slowly. Experience will give you the best practice in regard to ventilating. As a general practice it is found best to close the room tightly for a few hours so as to heat the contents to the highest degree and then open the ventilators. The air for the furnace may be taken from the outside of the room through a pipe.

(3) J. T. asks: How can I unite by casting a piece of mushett steel to the end of a piece of cast iron 1½ square by 7 in. long? The steel is 1½ square by ½ in. thickness. A. Make a core print to correspond with the steel, lay the steel in the mould, gate beneath to allow the iron to escape, and pour and waste perhaps one or two pounds so as to heat the steel; then plug up the waste gate and fill the mould.

(4) C. A. K. asks: What kind of liquids or gas are fire extinguishers charged with, especially the new hand grenade of Chicago, Ill.? A. Fire extinguishers are generally charged with carbonate of lime or carbonate of soda and water, with a combining quantity of sulphuric acid in a position to be discharged into the water at the required time. We do not know the construction of the Chicago hand grenades.

(5) H. B. C. says: In answer to D. D. L., query No. 19, Dec. 22, I clean my mica as follows: Take them out of stove, lay on a smooth board, and with a stiff bristle brush dipped in concentrated ammonia brush the surface until it feels smooth and glossy, then wash off the dirt and rinse with soft water. If the mica is not shelly, they will be as bright as new. Shelly or mica of poor quality can only be cleaned by stripping.

(6) W. H. writes: Will you tell me the reason that an ax at one corner and sometimes both cracks in tempering it, and how to prevent? Also a good receipt for small springs, such as main spring to gun locks, and other small springs? A. To prevent the cracking of an ax in hardening, have the iron poll split to receive the steel bit; not the bit to receive the poll. Heat the iron as well as the steel, and plunge into clear cold water until chilled. Use the best of cast steel for gun lock main springs. Forge to size. Do not use a file on the springs. Heat over a charcoal fire, harden in water, and draw the doubled-over portion to a blue.

(7) J. W. H.—Inquiry No. 8, SCIENTIFIC AMERICAN of Dec. 1, 1883, concerning quantity of water for boiler. In our reply we should have said cubic foot instead of gallon. The inquiry and answer as corrected stand as follows: How many gallons of water are required for a steam boiler per horse power, say at 60 pounds pressure? A. At the Centennial Exhibition and tests, 30 pounds steam per horse power per hour was taken as standard; this is a little less than half a cubic foot of water, but it depends much on the character and condition of the engine through which the steam is worked. The quantity of water may vary from one-third of a cubic foot to two-thirds of a cubic foot and even one cubic foot in a very bad engine.

(8) S. R. asks: Will any fellow reader acquaint me with any cheap liquid that will keep an even temperature (or nearly so) the year round? What are the non-conducting properties of oils or water glass?

(9) H. S., of Russell, Kas., asks the specific gravity of pure milk by a lactometer? A. The specific gravity of milk varies with the different breeds and age of cattle, the season of year, and kind of feed. We have records of specific gravities ranging from 1·035 to 1·04, the variation being due to the proportions of casein, sugar, salts, and fat. The excess in casein, sugar, and salts produces the heavier specific gravities, while the grades containing an excess of fat globules (cream) are of the lighter specific gravities. The lactometer measuring only the always slight variations between the weight of milk and that of water, must be very accurate to afford any guide, and we have known farmers who reported a difference of 20 degrees in the milk by a lactometer in four weeks' change from feed to good pasturage in the spring. The actual amount of water in milk is very regular at about 87 or 88 per cent, though its cream or butter producing qualities vary much more widely.

(10) H. W., of Frankfort, Ky., asks about ventilating a drying room 8 x 12, and 6 ft. high, in which there are 400 ft. 1 in. pipe for heating, present arrangement not working well? A. The steam coil should be 5 or 6 in. above floor; the flat kinds are the most efficient. The ventilation inlet should be under the coil so as to spread the air as much as possible; the outlet also should be at several places, so that the current through the room will be nearly equal in all parts. Openings equivalent to 1 square ft. are sufficient for a room of 600 cubic feet and 400 ft. of 1 in. pipe.

(11) W. T. says: I am told that a thermometer in which, on being inverted, the mercury breaks in running to the top of the tube is not reliable; that instead it should form a vacuum in the bulb. Is this right? A. Theoretically, and with an absolute vacuum above the mercury, the latter should, when inverted, fill the tube. But when the latter is very small a slight cause, a little roughness, or obstruction too diminutive to be seen with the naked eye, may cause a parting, and the instrument still be practically useful. It is very desirable to have a thermometer as perfect as possible. The break in the column does no harm provided it does not separate in the proper use of the instrument.

(12) J. B. F. M. asks: 1. Is the Blake transmitter as good as any? A. For general purposes, yes; it, however, lacks power for long distances. The Hopkins transmitter, by actual test, has proved the best for long distances. 2. Is the induction coil in the Blake transmitter composed of more than one sized wire, and what sizes and amounts are used? A. Yes, two layers of Nos. 16 and 18 insulated copper wire are wound in a coil ⅞ in. diameter by 1⅛ in. long for the primary, and over that is wound from five to six layers of No. 34 silk covered wire for the secondary wire. The resistance of the secondary coil is usually 150 ohms. 3. If a larger coil was used than ordinary, would it give better results? A. No, except for long lines of great resistance; then a larger coil is better. 4. What is the spring made of that carries the platinum point? An alloy of tin and brass something like German silver, to give it softness and elasticity. 5. What kind of carbon is used? A. Fine French battery carbon highly polished. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 163 and 150.

(13) A. S. P. writes: I have been trying to electroplate with two jars, Grenet battery, 7 in. high, object about 1½ in. square. I get a deposit of copper, but it takes a long time and consumes too much zinc. What is the fault? Can I not get good effects with that battery? A. Use two or three cells of gravity battery. The Grenet is not well adapted to electroplating.

(14) W. W. M. says: I have a glass wheel, the remnant of an old electrical machine. It is about 2 ft. in diameter and ⅝ in. thick. Can it be utilized in making a Holtz machine? If so, what thickness would be best for the additional wheel? A. It is a curious fact that plate glass is worthless for a Holtz machine. The natural surface of ordinary blown glass seems to be necessary to the successful working of the machine. Your plate would answer for a frictional machine.

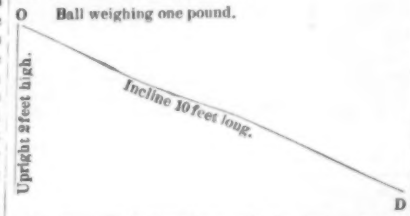
(15) J. H. B. asks: 1. Is not properly secured cistern or rain water the best for drinking and cooking purposes? A. We do not consider that cistern water in its best condition is equal to water drawn from sand or rock beds, but is no doubt better than the water of many wells. 2. Is there any danger arising from the use of water in brass or copper vessels? A. Brass and copper vessels that are kept scrupulously clean are suitable for cooking in or holding water for drinking. Brass pipe for conveying water is now much used, and is not considered more dangerous than lead pipe. 3. What effect, if any, has the rubber pipe upon water secured through it, such as our lawn and sidewalk hose? A. Rubber hose has no deleterious effect upon water. 4. Where is the best water found when exposed to the sun and air, and standing in open vessels—at the top or bottom of the vessel? A. We do not know that there is any difference in the quality of water drawn from the top or bottom of an open vessel, provided both vessel and water are clean.

(16) W. W. asks: What is the best material to mix with gas tar to form a durable waterproof coating for tin, shingle, or pap r roof? A. Boil the tar with lime, stir in powdered slate, and then apply.

(17) F. T. K. G. writes: I was much interested in the article entitled "The re-enforcement of deficient water supply in wells," which appeared in the SCIENTIFIC AMERICAN of November 10, but it does not explain how to manage where there are large quantities of granite bowlders, which is the case in many parts of the country. A. The deepening or re-enforcing of wells located in bowlder strata is not easy work. It requires much judgment and patience to bore out the sand and fish out the bowlders as they are laid bare. The strainer pipe should be much larger than those used for wells in clear sand strata. Sounding the substratum of the well with a small iron rod pointed and driven down several feet at different places close together and near the center of the well will generally reveal its condition as to the number and size of the bowlders, and will suggest the size of the strainer, which should be large enough to allow the bowlders to be drawn up with a finger grapple. The sand may be taken out as in the process before described. The bowlders can be loosened with a hook and taken up with the finger grapple. If the bowlder catch under the edge of the tube, bore down near it and below it and work the bowlder toward the center with a hook, where it can be caught with the grapple.

(18) E. D. C. asks for a rule by which he can solve the following problem:

O Ball weighing one pound.




Question: With what force will the ball weighing one pound strike an upright at D, having traveled the ten foot incline? A. A body acquires the same velocity in descending any inclined plane as by falling freely through a distance equal to the height of the plane minus the friction due to the manner of moving down the plane. The impact in foot pounds equals the velocity multiplied by the weight. To get the velocity, multiply the space fallen through by 64·333, and the square root of the product will give the velocity acquired in feet per second. In your case $\sqrt{2 \times 64{\cdot}333} = 11{\cdot}334$ feet per second, $11{\cdot}334 \times 1$ lb. $= 11{\cdot}333$ foot pounds. In practice this has been exceeded under favorable circumstances 4·496 times, so that you may obtain in practice any value in pounds for a one pound ball, from 11 to 44 pounds.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. N. T.—The specimen is probably infusorial earth, but it is too gritty to be of much use for polishing purposes. It has no commercial value in New York.

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